October, 1947

THE FOUNDRY

wherever metals are cast...

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DETROIT

Placed on a pedestal for contribution to better castings

Famous CORNELL FLUX

FAMOUS CORNELL CUPOLA FLUX

Leading foundries are high in their esteem for this amazing metal cleanser. Everywhere, the report is "definitely better castings, clean cupolas and clean drops." SCORED BRICK FORM enables them to flux each charge of iron in a few seconds--correctly.

FAMOUS CORNELL FLUX
Trade Mark Registered

The CLEVELAND FLUX Company
1026-1036 MAIN AVENUE, N. W., CLEVELAND 13, OHIO
Manufacturers of Iron, Brass and Aluminum Fluxes, Since 1918

the Camera Proves the Value of PURITE

IN REFINING CUPOLA CAST IRON!

MICROPHOTOGRAPHS OF GRAY IRON CASTINGS

(500 X Unetched)

Untreated Iron

Iron Treated with 4 lbs. of Purite per ton

ANALYSES AND TESTS

.137%	Sulfur	.104%
.93	Combined Carbon	.79
3.38	Total Carbon	3.36
1.84	Silicon	1.83
.30	Manganese	.27
.53	Phosphorus	.54
32,020 lbs.	Tensile Str. Per Sq. In.	33,750 lbs.
226	Brinnell Number	220
30"	Machinability	20"

Time in seconds required to drill through 1" test bar with ½" twist drill at 50 lbs. pressure and 1,700 r.p.m.

Refining with Purite—in the cupola hearth or in the ladle—has found favor with foundrymen for over 20 years. This scientific flux not only removes sulfur, it purges molten metal of occluded gases, entrained oxide-silicates and other non-metallic impurities. Purite makes possible improved grain structure and machinability... faster production of cleaner, sounder castings.

As a typical example, Mathieson shows the effect of desulfurizing and refining with Purite in a U-shaped mixer ladle. Microphotographs, analyses and tests—made before and after treating iron with Purite — clearly illustrate the manner in which Purite reduces the size of graphite flakes, cleans the metal, and improves the strength and machinability of gray iron castings.

99% PURE FUSED SODA ASH

PURITE

The Scientific Flux for Better Melting and Cleaner Iron

We'll be glad to tell you more about this inexpensive means of improving your castings. Write for free information. The Mathieson Alkali Works (Inc.), 60 East 42nd Street, New York 17, N. Y. In Canada: Railway & Power Engineering Corporation, Limited.

Mathieson
CHEMICALS

Purits (Fused Soda Ash) . Liquid Chlorine . Caustic Soda . Soda Ash . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua . . . Sodium Chlorite Products . . . Chlorine Dioxide HTH Products . Dry Ice . Carbonic Gas . Sodium Methylate

For jobs like these-

Cleaning up heavy castings presents no problem when you're using chisels made of Omega.

OMEGA is your steel

Omega is top choice for breaking out stubborn cores in fast time.

Bring on your cold-battering jobs. But be sure to use Omega chisels for chipping and core-breaking, for then you've got a steel that's been bred for the job. Omega is engineered for extra shock-resistance. It gives you a chisel that stands up under powerful, rapid-fire blows. The cutting edge stays sharp; the shank is non-peening.

Omega is easy to forge, machine, and heat-treat. Whether you make up your own chisels or buy them ready for use, there's no better steel for chipping and core-breaking work.

The nearest Bethlehem district office or tool-steel distributor will gladly give you complete information. Omega is available for immediate delivery.

OMEGA FOR SHOCK-RESISTANCE

Tensile strength	—340,000 psi max.
Yield point	—280,000 psi max.
Unnotched Charpy	—130 foot-pounds
Normal working hardness	—Rockwell C, 58-60

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

OMEGA . . . one of Bethlehem's Fine Tool Steels

"BOY, FETCH ME A SACK OF COLLOIDAL GELATINATING SILICATE OF ALUMINA!"

what the professor means is a bag of

FEDERAL GREEN BOND

Foundrymen know also that GREEN BOND controls sand strength; it rejuvenates dead sand; it gives greater sand flexibility; it permits sand to be worked with a lower moisture content; it is the most practical method of developing and controlling green strength. That's why FEDERAL GREEN BOND is used by foundrymen every day, everywhere.

Best of the Wyoming Bentonites

THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71st Street • Cleveland 5, Ohio

Seacoal Plant — Mines

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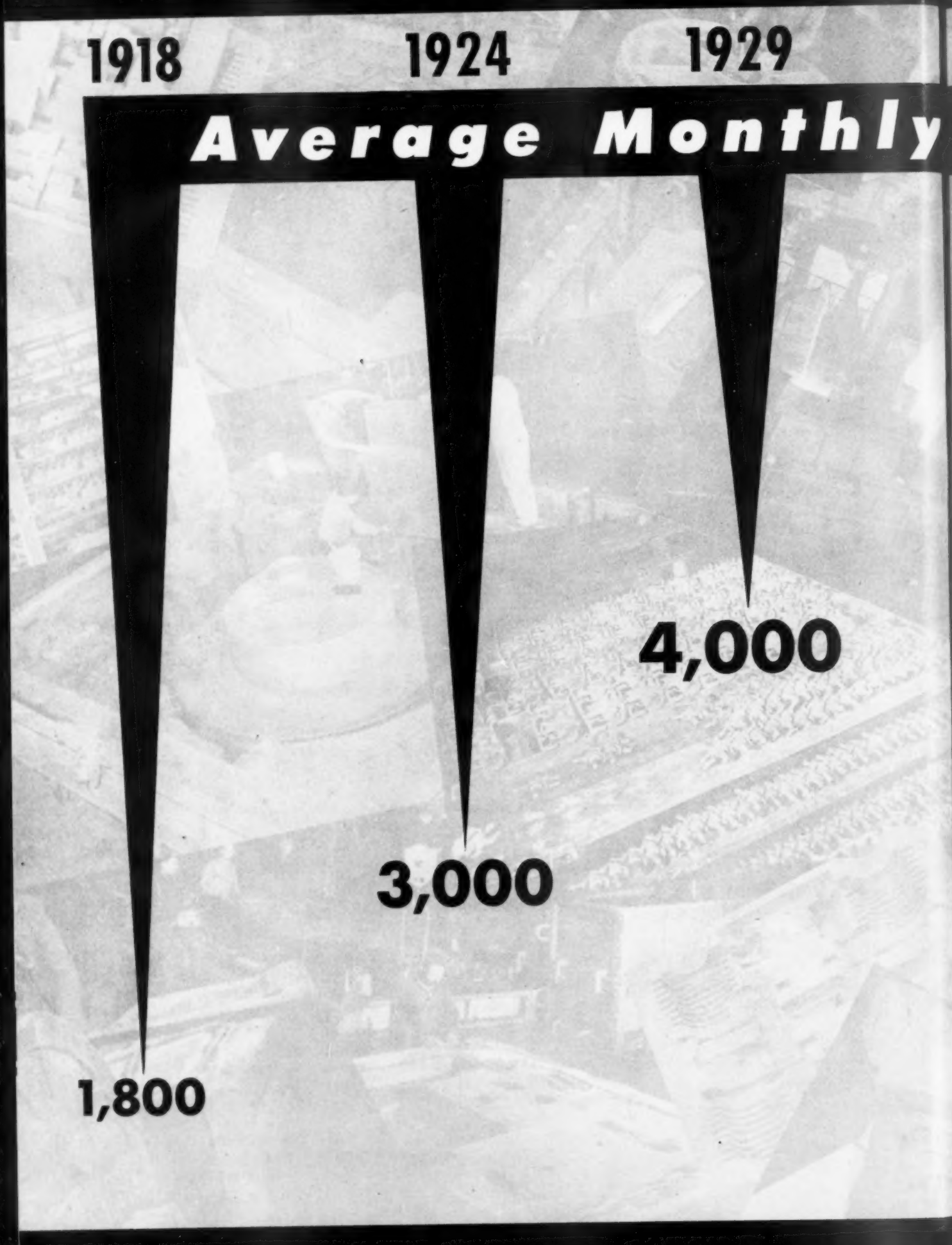

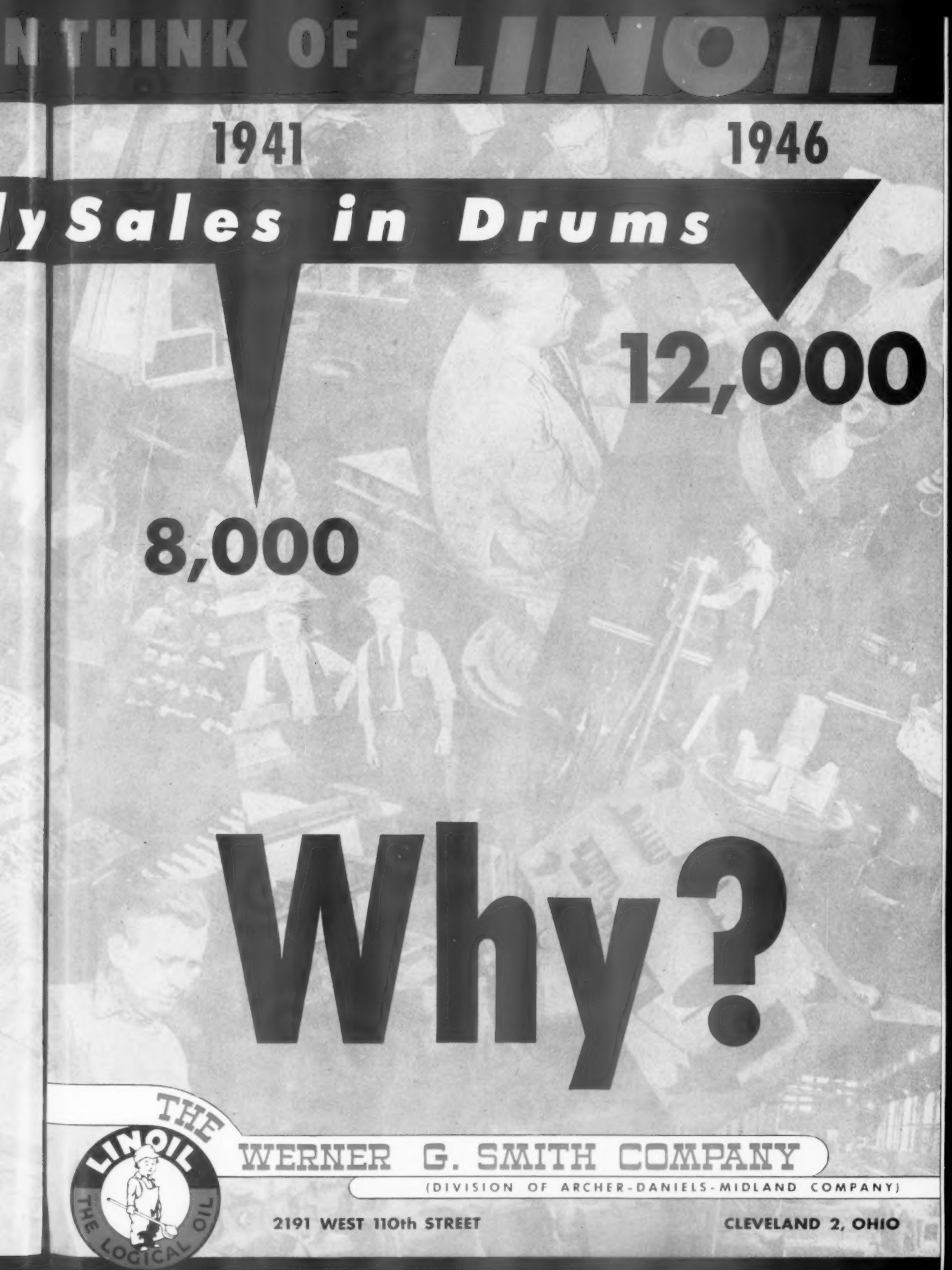
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1946
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12,000
8,000
Why?
THE LINOIL THE LOGICAL OIL
THE WERNER G. SMITH COMPANY
(DIVISION OF ARCHER-DANIELS-MIDLAND COMPANY)
2191 WEST 110th STREET
CLEVELAND 2, OHIO

ROCKING BARREL ACTION SAVES 4

BETTER, FASTER, CHEAPER

Rocking the barrel eliminates tangling, makes sure all surfaces get exposed to the blast. *Exclusive* deflector cleats speed up cleaning by keeping the pieces in the intensive blast area.

The ROTOBLAST unit uses centrifugal force to propel metal abrasive without crushing or waste. And an *exclusive* abrasive separator and cleaning system restores usable abrasive to original cleanliness and efficiency by stratification and pneumatic treatment.

For further information on Pangborn ROTOBLAST Barrels, Tables, Special Machines, come to Pangborn.

Pangborn Corporation, 1300 Pangborn Boulevard, Hagerstown, Maryland.

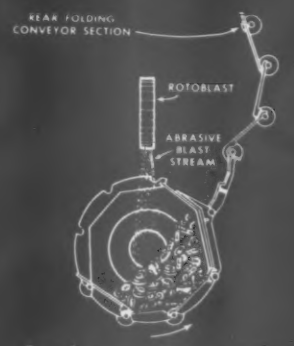
More than 24,900 Pangborn Machines Serving Industry . . .
Symbol of Quality Since 1904

BLAST CLEANS CHEAPER WITH THE RIGHT EQUIPMENT FOR EVERY JOB

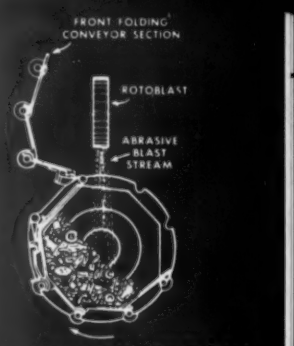
40% saving in cost of blast cleaning castings, forgings, and heat-treated parts is a typical return on an investment in Pangborn ROTOBLAST* Rocker Barrels.

An *exclusive* rocking action that turns the work and Pangborn's famous ROTOBLAST unit combine to increase cleaning output 50% in Pacific Car and Foundry's Renton, Washington plant.

*Trademark of the Pangborn Corporation



Barrel in operation — reaches extreme rear rocking position — turning work under blast stream.



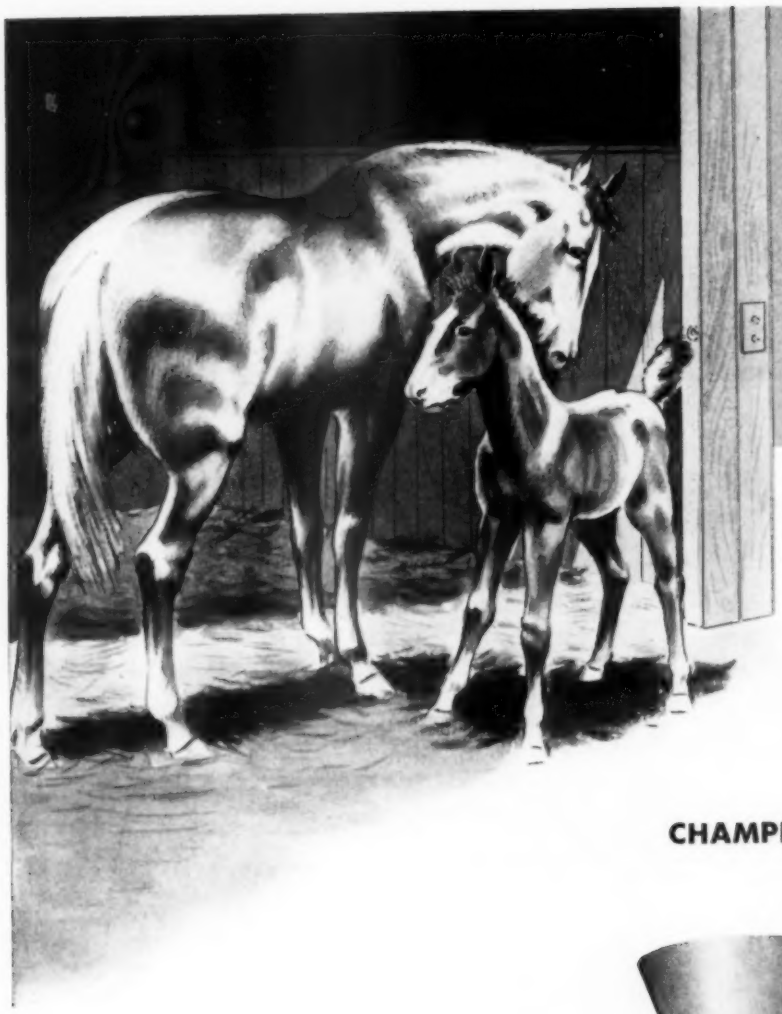
Barrel reverses to extreme front rocking position — again turning work under blast stream.

21-cu-ft capacity ROTOBLAST Barrel at Renton, Wash. plant. Also in this plant are a 14-cu-ft ROTOBLAST Barrel for smaller work, a single-spindle ROTOBLAST Table for flat and fragile pieces, and a Pangborn airblast room.

for Pacific Car and Foundry Company

Pangborn

PANGBORN CORPORATION, HAGERSTOWN, MARYLAND



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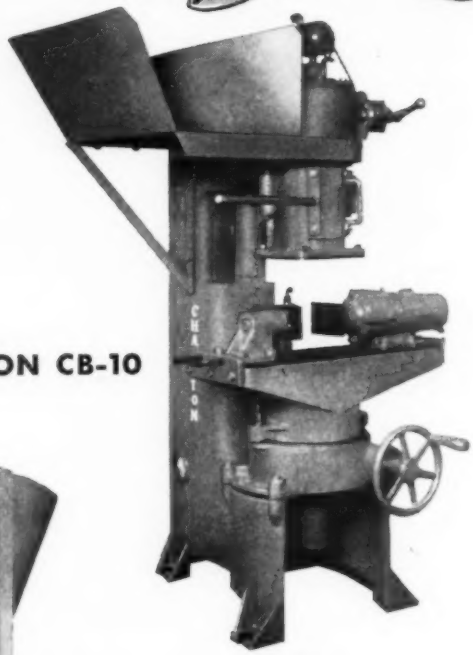

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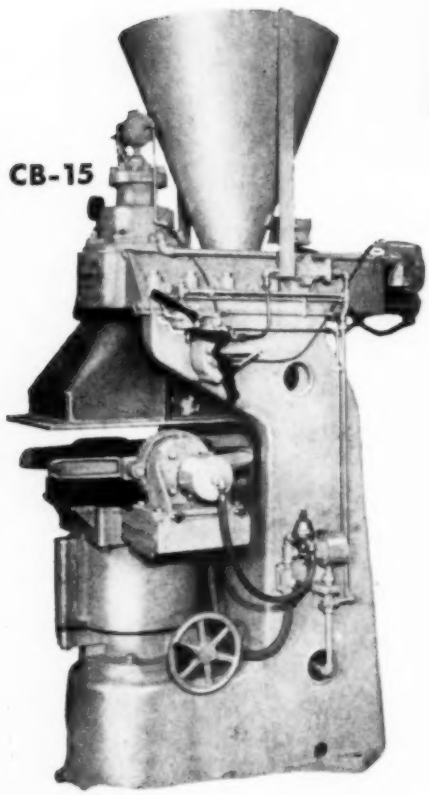
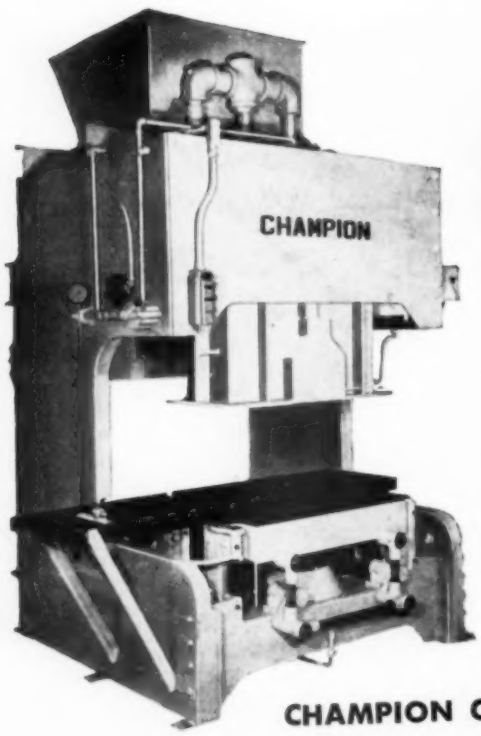
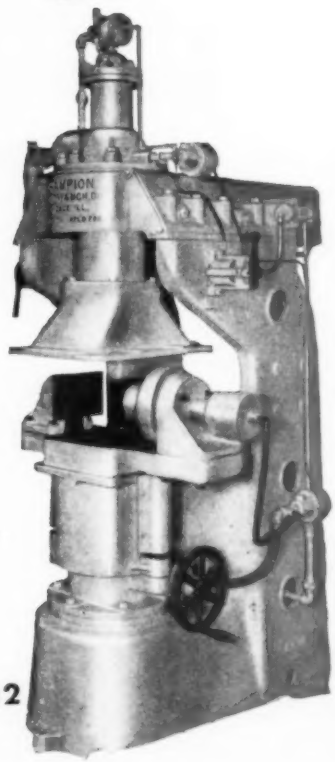
CHAMPION CB-15







CHAMPION CB-12

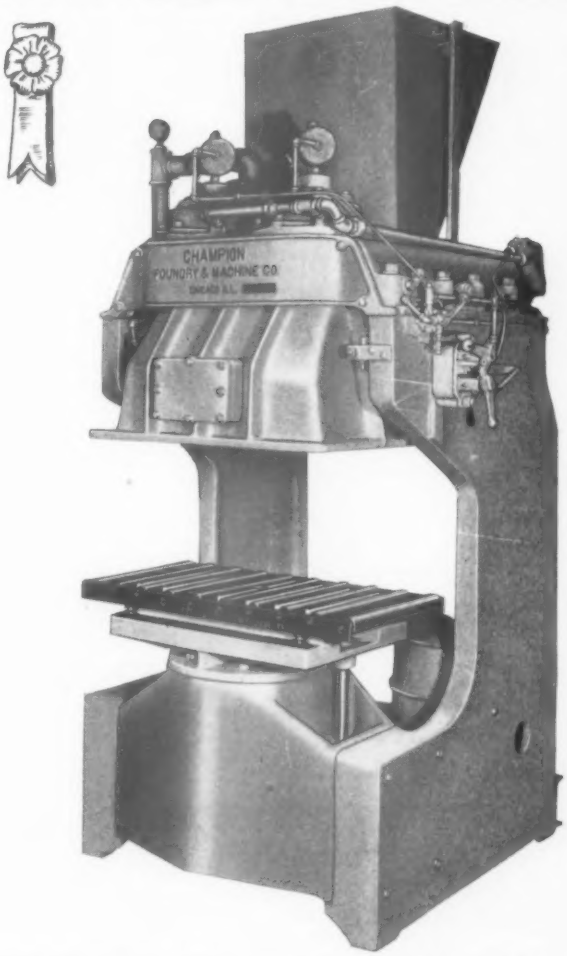
CHAMPION CB-400

a Line of Champions

COMES A NEW CORE BLOWER . . .

The CB-18

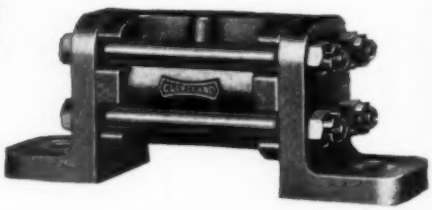
Constantly seeking improved performance to keep abreast of the advances of the foundry industry, Champion engineers have developed the new model CB-18 Core Blower, a worthy member of the Champion family and qualified for a star position on your team. The Champion line of five machines offers a range of size that will meet the requirements of the great majority of foundries. Each model possesses those distinctive features that are enabling some of the world's leading foundries to produce more cores of uniformly higher quality. In the days just ahead, when competition becomes keener, you will be glad you have Champions working on your team!



CHAMPION FOUNDRY AND MACHINE CO.
1318 W. 21st STREET CHICAGO 8, ILLINOIS

CLEVELAND 'Heavy Duty' VIBRATORS

A type and size for every requirement



Completely redesigned line of pneumatic vibrators for molding machines, hoppers, bins, chutes, etc. The best obtainable . . . for powerful, rugged and efficient service

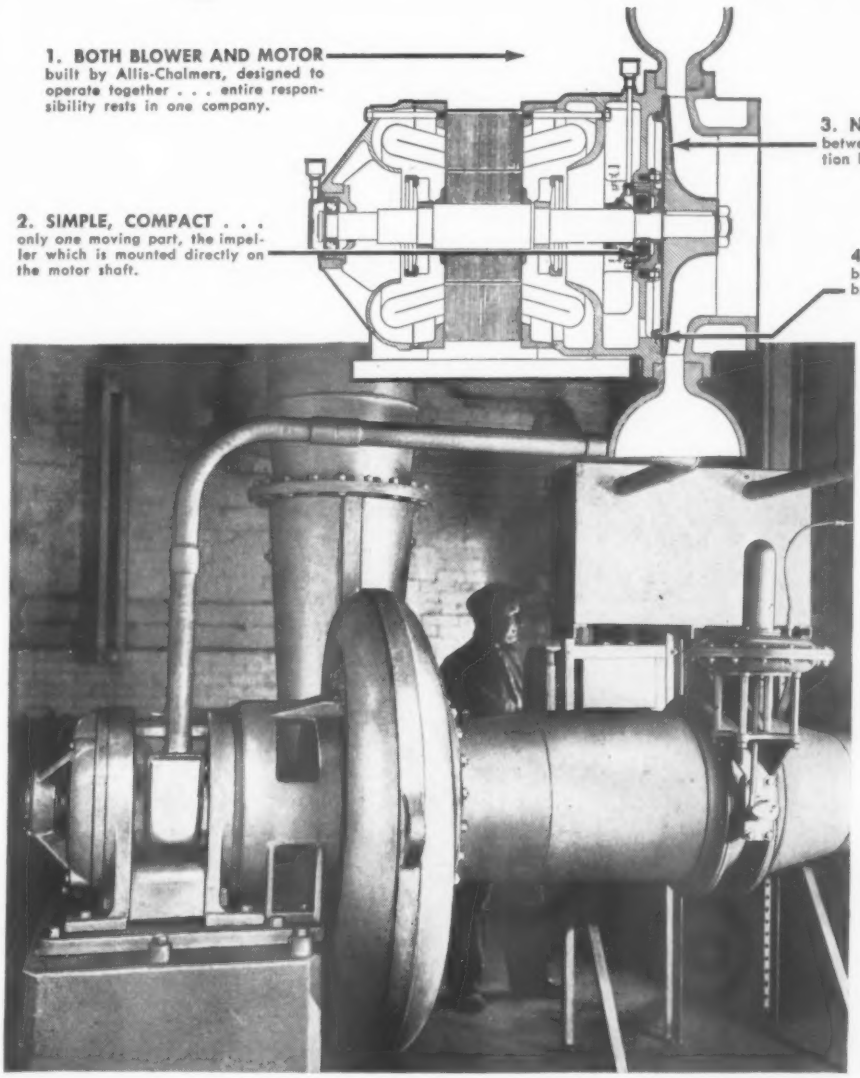
CLEVELAND

Try 'em!

CLEVELAND VIBRATOR COMPANY

★ 2828 Clinton Avenue Cleveland 13, Ohio ★

Specify Allis-Chalmers Cupola Blowers - *IT PAYS!*


1. BOTH BLOWER AND MOTOR built by Allis-Chalmers, designed to operate together . . . entire responsibility rests in one company.
2. SIMPLE, COMPACT . . . only one moving part, the impeller which is mounted directly on the motor shaft.
3. NO METAL TO METAL CONTACT between moving parts. Heavy, anti-friction bearings are the only wearing parts.
4. SEAL RING ON IMPELLER balances end thrust . . . reduces bearing loads to a minimum.

Foundrymen, Consultants:

ONE OF THE BIGGEST FACTORS in overall cupola operating economy is the blower. That's why it's just sound business to have all the facts about all types of blowers before you go ahead.

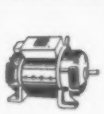
For example: The design of *Allis-Chalmers* cupola blowers stems from over *60 continuous years* building high speed rotating equipment. Hundreds have been installed, and the very first units are still operating. Users say A-C blowers are easy to maintain . . . low in operating cost . . . that they have unusually long life.

So compare *before* you buy, prove to yourself that "it pays to specify 'Allis-Chalmers'." ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2293

A-C BUILDS BASIC MACHINES, BLOWERS, PUMPS, DRIVES, ELECTRICAL EQUIPMENT FOR FOUNDRIES

ARC FURNACE transformers in any size for any furnace application. Five separate tap positions and a change from Delta to Wye connection give a wide range of voltages.

REGULEX* CONTROL for arc furnaces lowers and raises electrodes in response to rapidly changing conditions of the furnace charge. It makes possible lower cost melts, reduces electrode breakage.



COMPLETE LINE of motor controls for every requirement of motor operation. Manual or magnetic, reversing and non reversing, across the line or reduced voltage, single or multi-speed.

SEND FOR BULLETIN 07B6092A, "Foundry Mechanization"— It's packed with helpful, usable information on the *entire* Allis-Chalmers line of heavy foundry equipment.

*Allis-Chalmers Trademark

ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

DELTA
NO-VEIN
COMPOUND
ADDED TO CORE AND FACING SAND MIXES

✓ Eliminates Veining . . .
✓ Prevents Metal Penetration

DELTA FOUNDRY PRODUCTS CUT PRODUCTION COSTS

PLASTIC-type Core & Mold Washes . . . For Steel, Malleable, Grey Iron and Non-Ferrous Metals. Highly refractory, Waterproof, Non-deteriorating.
NO-VEIN Compound . . . Prevents veining and metal penetration.
CHILLKOAT . . . Eliminates use of metal chills on Grey Iron Casting.
SPRAY BINDERS . . . Produce dry sand mold properties.
PERMI-BOND . . . The economical, highly efficient Seacoal Replacement.
PARTEX . . . The original, and ONLY, Nut Shell Parting.
BONDITE . . . The NEW Waterproof 100% Dry Binder.
MUDDING COMPOUND . . . A highly refractory material for patching joints.
CORE ROD DIP OILS . . . Make stronger cores. Cause sand to adhere to core rods and wires, after baking.
SAND CONDITIONING OILS . . . Stop all sticking of sand in core boxes.
PYRO-KOAT . . . A new powder wash—when applied as directed on green sand molds produces dry sand mold results.
LIQUID PARTING • CORE OILS AND BINDERS.

Add only a small quantity of DELTA NO-VEIN COMPOUND (1% to 3% maximum) to your core sand and eliminate troublesome veining of cores.

DELTA NO-VEIN COMPOUND is a specially prepared and compounded series of oxides which develop the necessary hot strength without, in any way, deteriorating the sand.

DELTA NO-VEIN COMPOUND retards sand grain expansion, practically eliminating the possibility of metal penetration.

Write for a liberal working sample. You will also receive complete instructions for use.

DELTA OIL PRODUCTS CO.
MILWAUKEE 9, WISCONSIN

SAVE
EXTRA HANDLING!

USE CMD *DUAL-PURPOSE CORE TRAYS*

The CMD Dual-Purpose Core Tray can be used for baking the cores, thus eliminating transfer of cores from core plate to core tray.

Because of their lock-stacking features, these trays make possible storage from the floor up. Bins and racks are no longer necessary.

SPECIFICATIONS

SIZE—12" X 24"

LOADING HEIGHT—4½"—6" OR 7"

OVERALL HEIGHT—5½"—7" OR 8"

WEIGHT—9½ POUNDS

MATERIAL—16 GA. SHEET METAL

SPOT WELDED (28 POINTS)

ALL ROUNDED CORNERS

2 BOTTOM REINFORCEMENT ANGLES

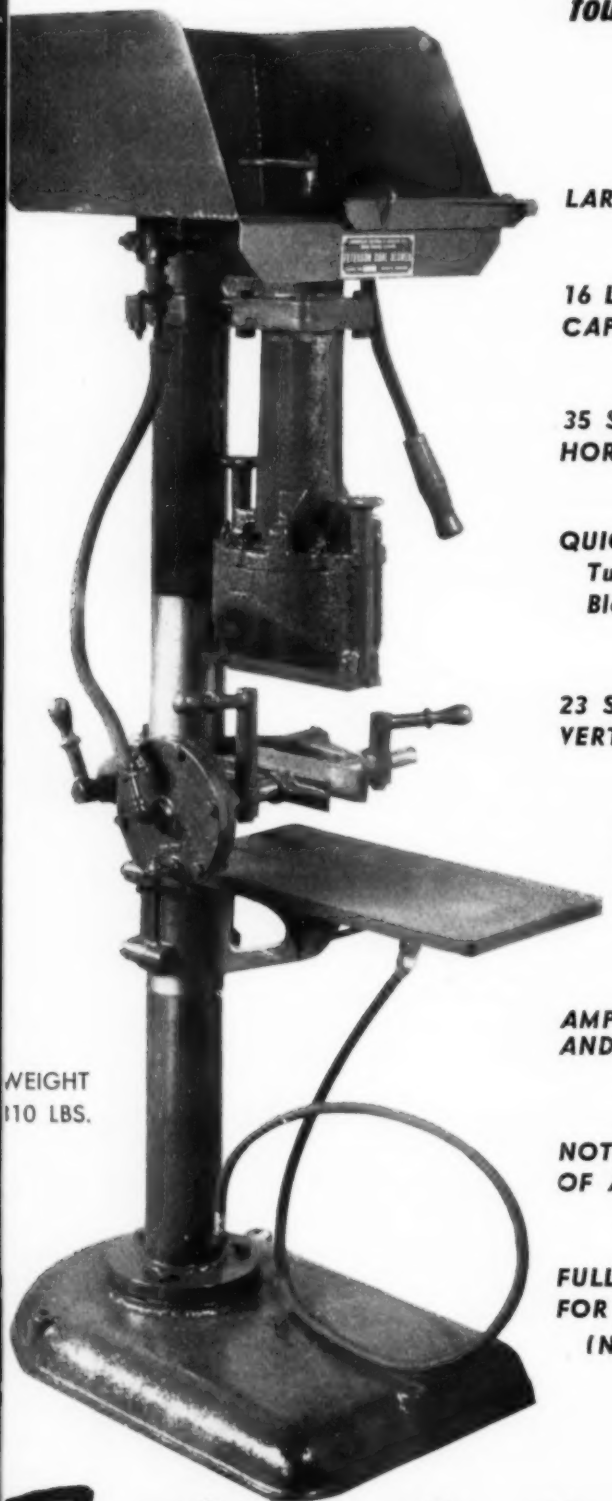
CONSTRUCTED FOR STACKING

CHICAGO MANUFACTURING & DISTRIBUTING CO.

Dept. 5F, 1928 West 46th St. CMD **Chicago 9, Illinois**

ANNOUNCING... the completely NEW and simplified Peterson Core Blower

Designed for greater capacities—constructed for easier maintenance, foundrymen praise its flexibility and moderate cost.



WEIGHT
110 LBS.

LARGE CAPACITY HOPPER

16 LBS. of SAND CAPACITY IN MAGAZINE

35 SQUARE INCHES HORIZONTAL CLAMPING AREA

QUICK-CHANGE FEATURE
Turn Knobs and Slip Off Blow Plate

23 SQUARE INCHES VERTICAL CLAMPING AREA

YOU ALWAYS CLAMP IN CENTER OF CORE BOX
Clamping Device is Fully Adjustable

AMPLE TABLE CLEARANCE AND WORK SURFACE

NOTE MINIMUM NUMBER OF AIR HOSES

FULLY LEVER-EQUIPPED FOR QUICK ADJUSTMENT
(No Wrenches Needed)

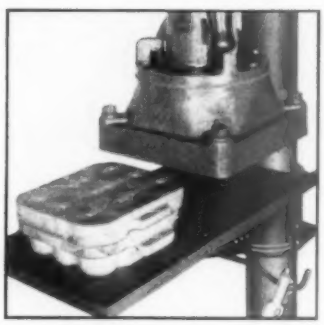
PATENT APPL. FOR

We invite your attention to several interesting NEW features of the Peterson Core Blower. From our 22 years' experience working with and for foundrymen, we believe that most prefer a blower which is easy to operate and maintain. Note, therefore, that we have designed a unit on which all adjustments are possible without the aid of wrenches.

Users tell us that it is a machine which the operator can easily and quickly understand. It is fully automatic, of course; pushing one lever completes the blowing and clamping cycle; and has an ingenious, fool-proof clamping mechanism.

The unit shown on the left is equipped with a magazine and quick change (and we mean quick change) blow plate for vertically split core boxes and a clamping device which may be adjusted to, at all times, clamp in the center of the box. Stools are not required to adjust for boxes of different heights. The blow plate is 2½" x 10½" and is changed in a matter of seconds. For pin cores there is nothing better at any price.

Square Blowhead Furnished for Horizontally-Split Core Boxes



• For greater capacity and horizontally split core boxes, the square magazine is furnished. It has a blow plate 10" x 10" with an opening 8" x 8", or you may choose a 10" x 12" magazine and blow plate. All magazines can be interchanged in a few minutes.

★ *WE INVITE YOUR INQUIRY FOR FURTHER INFORMATION*

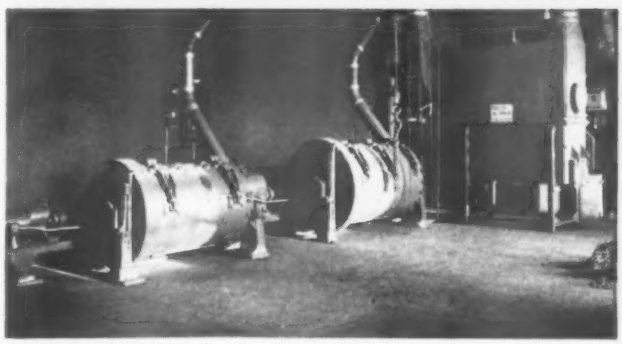
Interstate PATTERN AND MACHINE CO.

4431 FIFTH AVENUE ROCK ISLAND, ILL.

SELECTION of suitable cleaning equipment will not only bring savings in the cleaning process, but pay extra dividends in the machine shop and finishing room. The choice depends on many factors—type and size of castings, plant layout, finish desired, and cleaning cost per ton of castings.

Cleaner Castings at Lower Cost—

Whiting offers two types of equipment for cleaning castings—Whiting Tumbling Mills and Whiting Hydro-Blast Barrels. With over 60 years in serving the foundry industry, Whiting knows these processes cannot answer *every* cleaning problem . . . but ordinarily one or the other will meet most foundry and forge shop needs.



Two Whiting Tumbling Mills directly connected with a Whiting Hydro-Clone dust suppression unit.

Whiting Tumbling Mills

Tumbling is recommended not only for its low cost per ton of castings, but because the peening action makes castings stronger by reducing internal strains, and gives a better surface for painting.

Whiting Tumbling Mills are built for durability and safe, easy operation. Available with plain or roller bearings, multiple or individual drives, in sizes for all normal requirements. Write for descriptive Bulletin FY-123.

Unloading a Whiting Hydro-Blast Barrel. Note the clean, satiny surfaces of the castings.

Whiting Hydro-Blast Barrels

The Hydro-Blast process cleans with a high-pressure blast of sand and water, and is recommended for medium and small castings. It has been especially successful with nonferrous metals. The process is entirely dustless, and leaves the castings with a smooth, satiny finish.

Whiting Hydro-Blast Barrels are available in two sizes, with capacities of one and two tons per hour. Fully described in Bulletin FY-106 . . . sent on request.

WHITING CORPORATION

15607 Lathrop Avenue, Harvey, Illinois

Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Agents in other principal cities. Canadian subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N.Y.

THEY ALL LIKE HINES

HINES
POP-OFF
(Trademark Reg. U. S. Pat. Off.)
FLASK

. . . . THE BIGGEST MONEY-SAVER PER INVESTMENT DOLLAR IN THE FOUNDRY

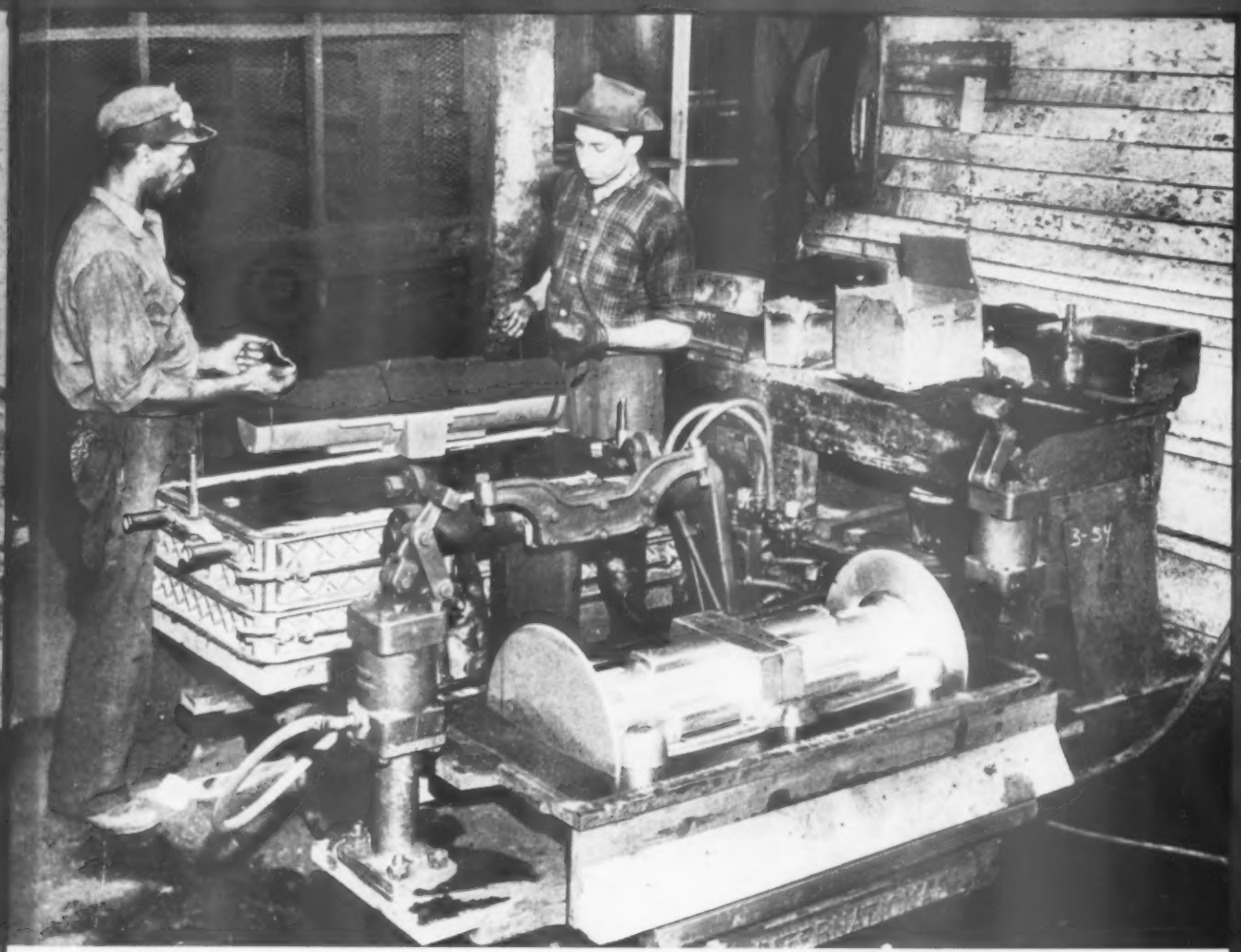
Fully Protected by Patents and Patents Pending

THE HINES

3431 WEST 140th ST.

"Pop-Off" FLASKS..

TRADE MARK



HINES "Pop-Off" flasks are receiving enthusiastic acceptance in foundries all over the country. They like the way these precision-built flasks perform under all foundry conditions. The patented "Pop-Off" feature eliminates pounding or mauling the flask—no shake-out costs—just upset the mold and hook the casting out. Serrations on the inside of flask do away with sand strips—prevent sag and drop in cope and drag—give more bearing and a tight joint at the parting line.

FLASK CO.

CLEVELAND 11, OHIO

FOUR P&H ELECTRODES Every Foundry Needs

Every one of these P & H Welding Electrodes is a cost saver for foundries—every one a "specialist" for certain foundry work. Together they can mean greater casting output . . . fewer "throw-outs". . . more profitable operations.

P&H "AP"—For All-Position Welding

A versatile electrode for all-purpose, all-position welding of mild steel. Welds are machinable as deposited or heat treated. For filling in cavities, defects, etc. AWS class E6010.

P&H "PF"—For Poor Fit-up Welding

An extremely useful foundry electrode for joining mild steel castings. Saves making costly, intricate one-piece castings when components can be fabricated. Welds are machinable as deposited or heat treated. AC or DC, AWS Class E6012.

P&H Lime Ferritic Electrodes for Joining Dissimilar Metals

A P&H development with various analyses widely used by foundries. Makes it possible to easily and soundly join high alloys to low alloys, nickel steels with carbon steels, high sulphur steels and many others.

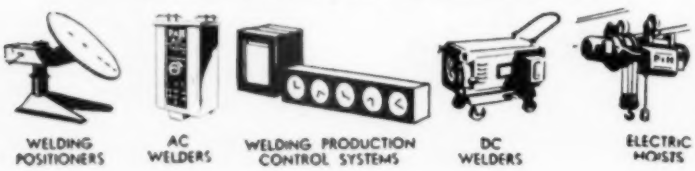
P&H Nicast for Machinable Cast Iron Welds

A new P&H Electrode that has won wide acceptance for foundry work. For welding surface blemishes, fabricating cast iron castings or for the joining of cast iron to steel. Weld deposits fully machinable. AC or DC.

A COMPLETE FOUNDRY WELDING SERVICE

Other P&H Electrodes — for hard facing, salvage and plant maintenance, etc.—make P&H a central source for all foundry welding needs. Call on this service for any welding help. Also, ask for handy, complete P&H Electrode Booklet R7-5.

AMERICA'S MOST COMPLETE ARC WELDING SERVICE



P&H WELDING ELECTRODES

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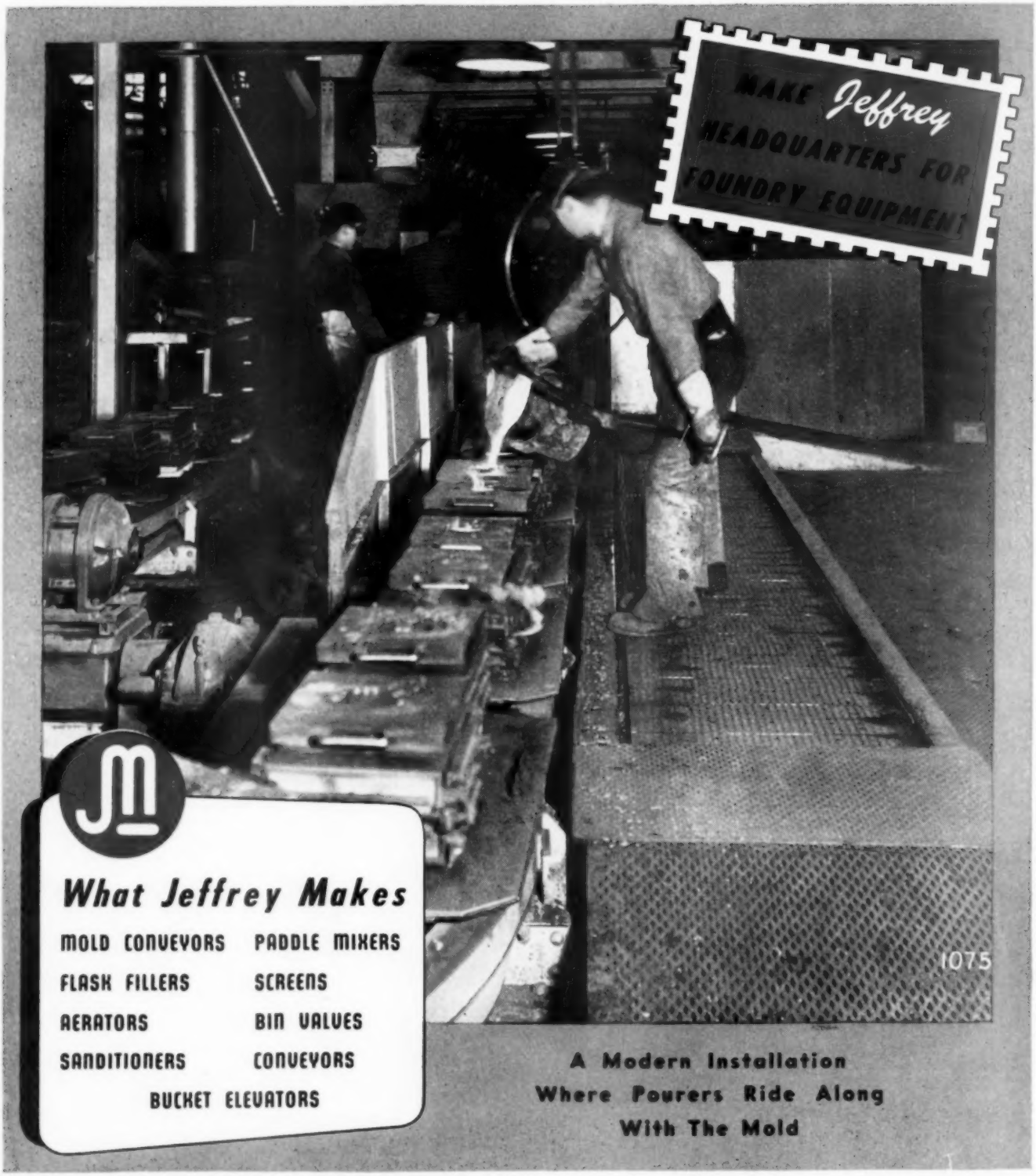

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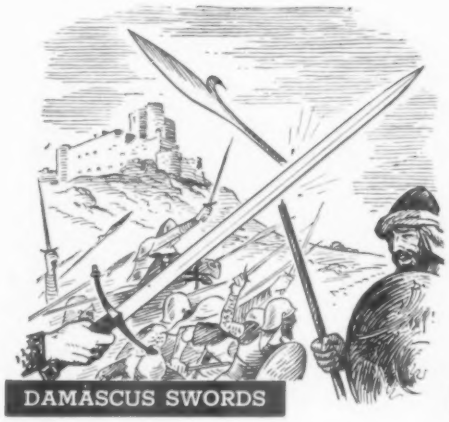
ESTABLISHED 1877

907-99 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

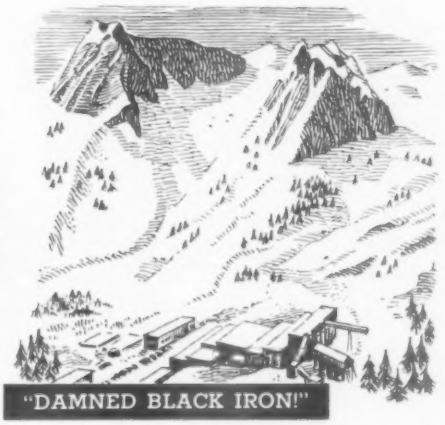
ONE OF A SERIES OF STORIES ABOUT ALLOYING METALS...WHERE THEY COME FROM AND HOW THEY ARE USED

THE STORY OF TUNGSTEN



DAMASCUS SWORDS

1 Tungsten has been found in medieval Damascus swords—so hard they could cleave iron spears at a blow, so keen they could cut floating gossamer, so elastic they would spring back to shape after being bent to a right angle. Yet it is only for about 50 years that tungsten has been known as a valuable alloying metal.



"DAMNED BLACK IRON!"

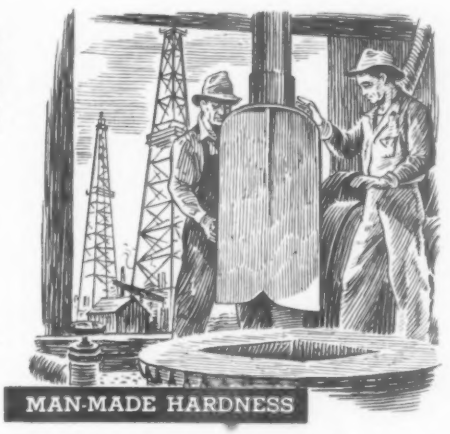
2 The exciting flash of gold was the dream of miners in gold rush days. They cursed when their pickaxes rang against a stubborn black rock—one of the tungsten ores, which has since sold for as much as gold ores. Tungsten ore is mined for Electromet's furnaces by United States Vanadium Corp. (a UCC Unit) at Bishop, Cal.

HOT AND HEAVY

3 Tungsten (which is Swedish for "heavy stone") gets hotter than any other metal before it melts—6,100° F. That's why it is used in electric lamp filaments and has many valuable industrial applications where high heat resistance is needed. Electromet produces pure tungsten powder, ferrotungsten, and calcium tungstate.

FOR CLOSE SHAVES

4 In cutting tools of high-speed steel and tungsten carbide and in the well-known HAYNES STELLITE non-ferrous alloys, tungsten produces a hard edge that stays hard even under extreme friction and high temperatures. Tungsten has other important uses, such as in the heat-resisting metals of gas turbines and jet engines.



MAN-MADE HARDNESS

5 Nature made the diamond, but man has created something almost as hard—tungsten carbide. This highly abrasion-resistant material is used for dies and tools and as a welded deposit on parts exposed to extreme wear. For instance, this tungsten alloy applied to drill bits enables oil men to drill wells almost three miles deep.

Help Wanted?

If you need help on some specific application of ferro-alloys or alloy steels, let Electromet work it out with you. Our modern, completely equipped research laboratories at Niagara Falls, New York, are staffed by men who have had years of experience in helping ferro-alloy users solve problems that arise in their plants and in the markets served by them. You can learn more about this unique service by writing to our Technical Service Department for the booklet, "Electromet Ferro-Alloys and Metals."

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

ELECTROMET Ferro-Alloys and Metals are sold by Electro Metallurgical Sales Corporation, and Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company

Electromet

TRADE-MARK

Ferro-Alloys & Metals

Serving Wisconsin Foundries

with the PRODUCTS of these Outstanding Firms

WISCONSIN'S LARGEST WAREHOUSE STOCK

- **Harbison-Walker Refractories Co.**
  REFRACTORIES
- **Northwestern Steel & Wire Co.**
  NAILS AND CORE RODS
- **Joseph Dixon Crucible Company**
  CRUCIBLES, FURNACE COVERS, REFRACTORIES
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PLUS THE FOLLOWING PRODUCTS OF OTHER WELL-KNOWN MANUFACTURERS:

Parting — Core Paste — Sea Coal — Pitch — Vibrators — Ladles — Flasks — Sprue Cutters — Sand Blast Sand — Shot and Grit — Riddles — Plumbago — Silica Flour — Shovels — Swabs — Brushes — Bellows — Bentonite — Leslie Bulbs — Fluxes — Liquidizers — Paste Bulbs — Core Box Vents — Mallets — Vent Wax — Specialties.

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Wisconsin's Largest Foundry Supply House

MILWAUKEE CHAPLET

Serving Foundries Everywhere

with the Famous Products of this Modern Plant

MILWAUKEE *Thread Stem Chaplets*

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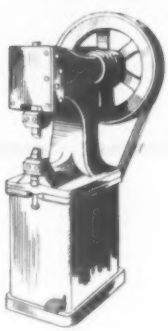

SCHMITZ *Chaplets, Tin Shells and other Tin Specialties*

The MILWAUKEE-TESSMER *Sprue Cutter for Non-Ferrous Foundries*

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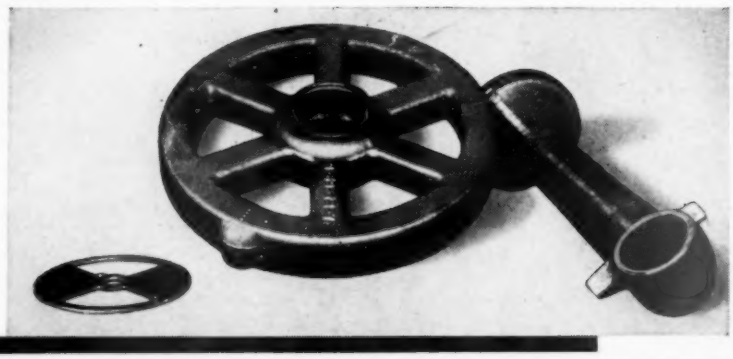
MILWAUKEE CHAPLET

A 5273-2P-C

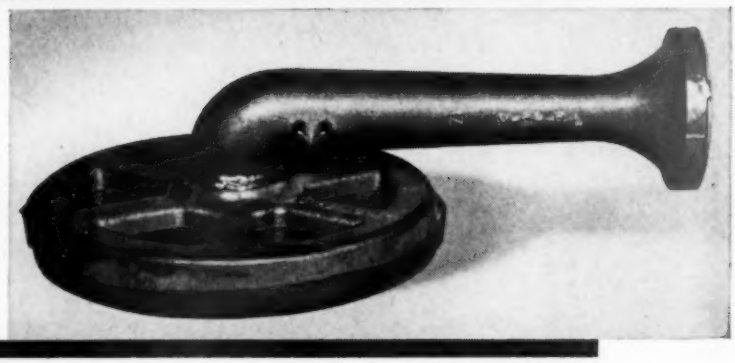
How NI-ROD saved a headache...

and brought a saving



BEFORE:

Parts of burner assembly for Luxaire gas-fired gravity furnace made by C. A. Olsen Mfg. Co., Elyria, Ohio.



AFTER:

Completed burner showing parts welded in place by Ni-Rod. Note smoothness of welds. Steel disc was joined to mouth of cast iron throat inlet by 4 tack welds 90 degrees apart.

IN ASSEMBLING the burners for their new "Luxaire" domestic gas furnaces, the C. A. Olsen Mfg. Co., of Elyria, Ohio, ran into trouble.

Ordinary cast iron electrodes wouldn't do the job of welding the cast iron burner heads to the burner throats. Welds cracked... parts failed.

After experimenting with many different electrodes, they finally discovered their solution . . . in NI-ROD.*

Ni-Rod, they found, united the two cast iron parts with strong, sound, crack-free welds.

It also welds cast iron to steel. So, the Olsen Company had no trouble in welding the slotted steel discs to the cast iron throat inlets . . . in the same operation.

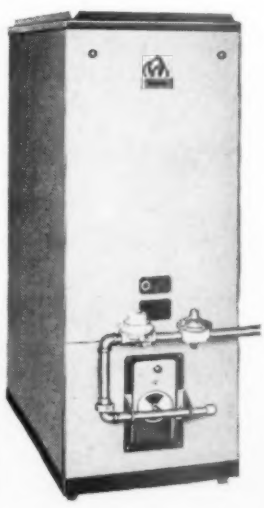
And, while improving their product, Ni-Rod also brought money- and labor-saving advantages. For example, Ni-Rod goes on so smoothly that extra finishing operations are unnecessary. The whole job is completed in a little more than a minute . . . without preheating . . . using only half an $\frac{1}{8}$" electrode.

Today, the Olsen Company reports that over 25,000 units have been welded with Ni-Rod and are giving A-1 service.

Find out more about Ni-Rod . . . how it can speed your production . . . save extra operations . . . save extra cost. Available in $\frac{3}{32}$", $\frac{1}{8}$", $\frac{5}{32}$", and $\frac{3}{16}$" diameters. Order a 5-lb. package from your nearest distributor listed below.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y. *Reg. U.S. Pat. Off.



"Luxaire" Series G Gas Fired Domestic Gravity Furnace Size: 5 ft. x 2 ft. x 3 ft. Output: 60,000 to 90,000 AGA B.T.U.

EMBLEM OF SERVICE

INCO NI-ROD TRADE MARK

SEND FOR INSTRUCTION BOOKLET

Get NI-ROD from:

WHITEHEAD METAL PRODUCTS COMPANY, INC.
WILLIAMS AND COMPANY
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HENDRIE & BOLTHOFF MFG. & SUPPLY CO.
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AIR BLAST* ROOM CLEANING

Fills an Important Foundry Need

For 43 Years Pangborn has met this need -- *with constantly improved Room designs*

Among the features that make Pangborn Air Blast Rooms efficient and economical investments are:

- "Daybright" Electric Light Fixtures—*give evenly diffused illumination.*
- Latchless, self-closing, self-sealing adjustable doors—*are free from interference of floor litter.*
- "Down-draft" ventilating ducts—*give maximum visibility—minimum dust around operator.*

For complete data —

*For airless ROTOBLAST equipment see pages 6 and 7.

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. . . for your products.

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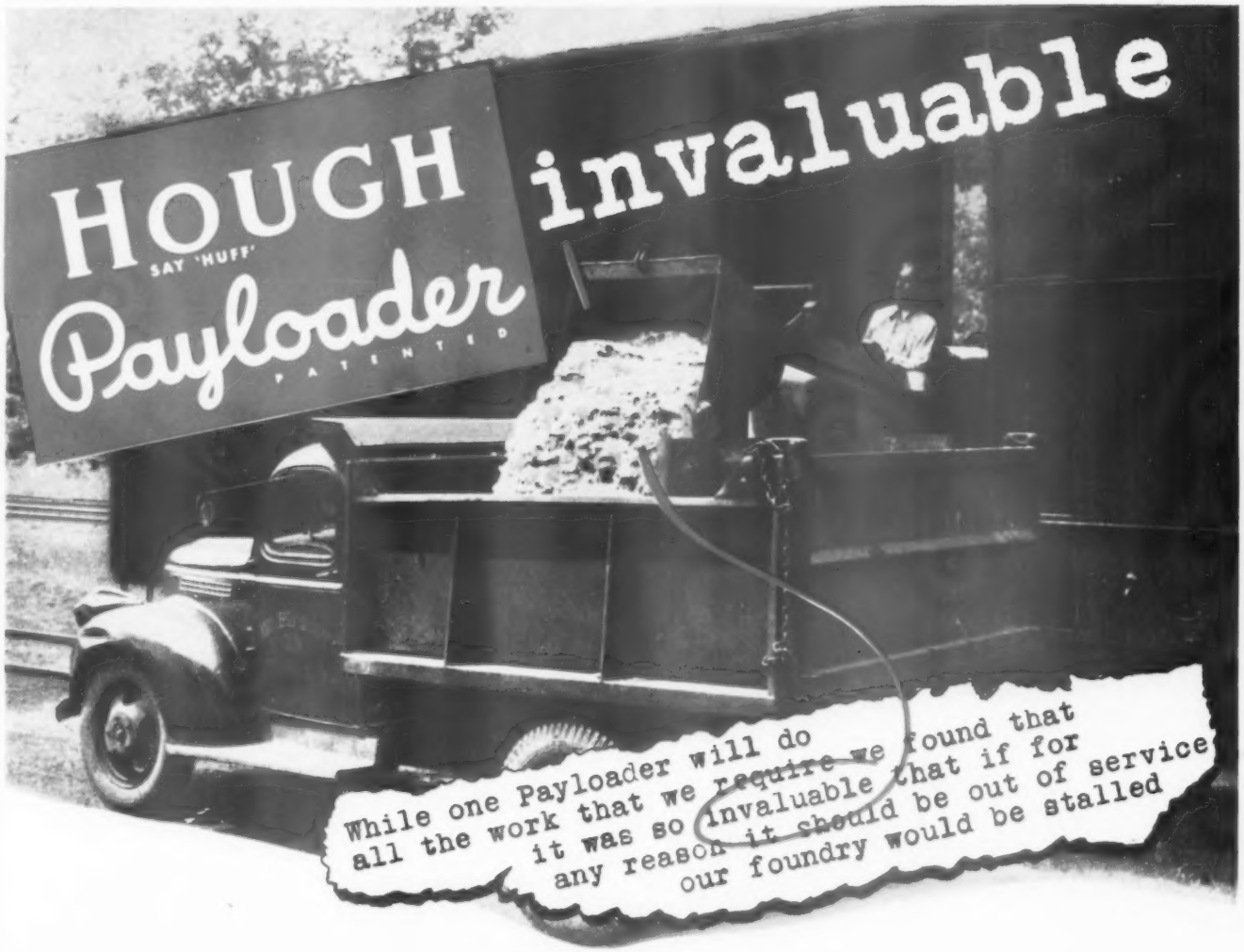

HOUGH
SAY 'HUFF'
Payloader
PATENTED
invaluable
While one Payloader will do all the work that we require we found that it was so invaluable that if for any reason it should be out of service our foundry would be stalled

PROVEN OVER 6500 HOUGH TRACTOR SHOVELS BUILT PERFORMANCE

Payloader shown here feeding Screenarator, also used to handle sand on floors, which used to take 9 men with shovels 6 hours — the HA and 3 men now do the job in 8 hours — a saving of 30 manhours.

SEND TODAY for bulletins on the Model HA 10½ cu. ft. Payloader, the ¾ yd. Model HF, and the 1 yard Model HL.

North Jersey Foundry Co., Inc., *SAVES TIME . . . MONEY . . . MANHOURS* with the Model HA Payloader

It's easy to see why the Hough HA Payloader has become such an important part of operation at the North Jersey Foundry Co., Inc., of Little Falls, N. J. Working speedily within the confines of a box car, the HA and one man unloads sand at the rate of 6¼ ton per hour — with the same man operating Payloader and truck. Where the HA unloads a 50 ton box car in 8 hours, it used to take two men with shovels 16 hours. Saved — 8 hours. Saved — 24 manhours. Saved — 48c per ton.

The North Jersey Foundry Co., Inc., also uses the HA to unload barrels of core oil from trucks, transport new sand to foundry and load waste sand and slag on a conveyor for disposal.

Hough Payloaders are repeating these same performance records in over 150 foundries throughout the country. Hough Payloaders are handling sand, slag, cores, coal, core oil; unloading box cars, filling bins, charging screening machines, hauling scrap, and performing hundreds of odd foundry tasks.

Put a Payloader in your foundry and watch operating costs go down, manpower problems disappear and profits go soaring.

THE FRANK G. HOUGH CO.

MATERIAL HANDLING EQUIPMENT SINCE 1920

703 Sunnyside Ave., Libertyville, Illinois

the Simpson Mixer is

—says Banner Iron Works, referring to the sand conditioning system they designed, built and installed in 1943, under the very able direction of Mr. W. E. Illig

Banner Iron Works
FABRICATED STEEL PRODUCTS
GRAY IRON CASTINGS
MEEHANITE METAL CASTINGS
4560 SHAW BOULEVARD
Saint Louis 10 August 21st, 1946

BIW

National Engineering Company
549 West Washington Boulevard
Chicago, Illinois

Attention: Mr. Webb L. Kammerer

Gentlemen:

During the defense program, we operated our foundry at approximately 400 tons a month with a #1 Simpson Muller which was purchased about 1910.

As the foundry demands for better mulled molding and core sands developed, and due to increased war production requirements, this small muller was forced to operate from 20 to 24 hours per day, and was still far below meeting the demands for properly conditioned sands. During 1940 a sand conditioning system was designed. This system was such that all of its various details had to function or the foundry could not operate. After some investigation, it was decided to purchase for this system, a #6 Heavy Duty Simpson Muller. The system was installed early in 1943. The equipment was originally designed to handle, the main bay, which requires about 100 tons; the side floor, 25 tons; and, two rollover machines, demanding about 100 tons, totaling about 225 tons daily. In addition to the main floor, heap and facing sands, core sand requirements are also prepared in this system.

After operating approximately a year on this basis, it was decided to condition the squeezer floor sand in the same system. The sand required for these floors is approximately 30 tons daily. As we use all synthetic mixes, all heap and facing sands pass through this system daily.

It goes without saying that the Simpson Muller is the heart of this system. In the event a defect occurred in the Muller, all molding operations would be forced to stop for want of sand as no sand is stored on the foundry floor. We are happy to say that we have had 3½ years of continuous operation, without shutdown, and that during this period, only a few minor repairs on the muller were necessary and, thanks to the service that the National Engineering Company gave us, we were able to make these minor repairs without interruptions in our molding operations.

Yours very truly,

BANNER IRON WORKS

W. E. Illig

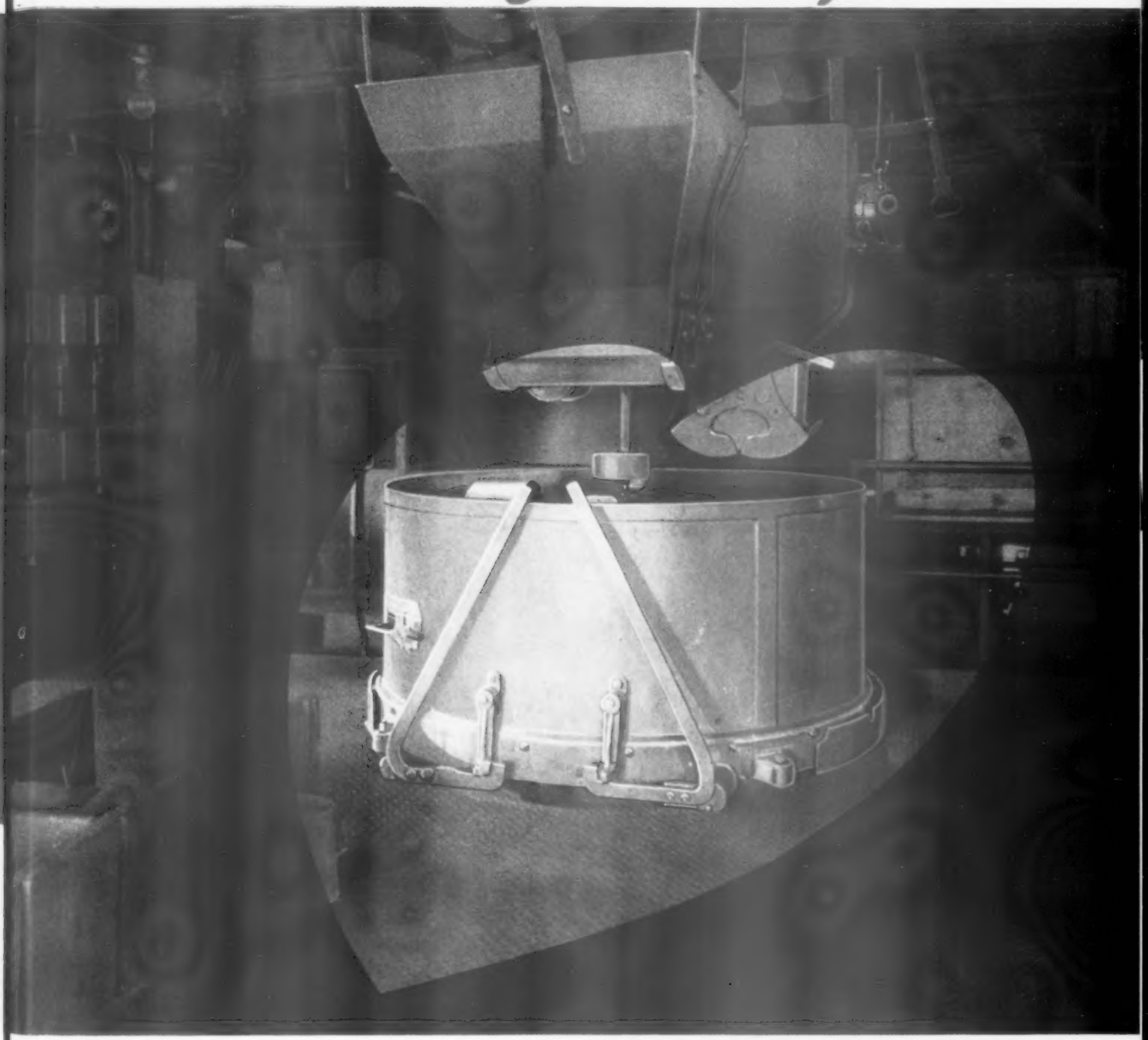
W. E. Illig
Vice President

• The accompanying letter is indicative of the way in which Simpson Mixers are meeting foundry demands for a greater production of better quality molding and core sands . . . day after day, year after year.

This evidence of superior performance is not an isolated case. On-the-job reports in foundries both large and small prove that Simpson Mixer installations are constantly producing foundry sand better, faster and at less cost.

Ask a National Engineer to discuss the details with you.

the heart of this system



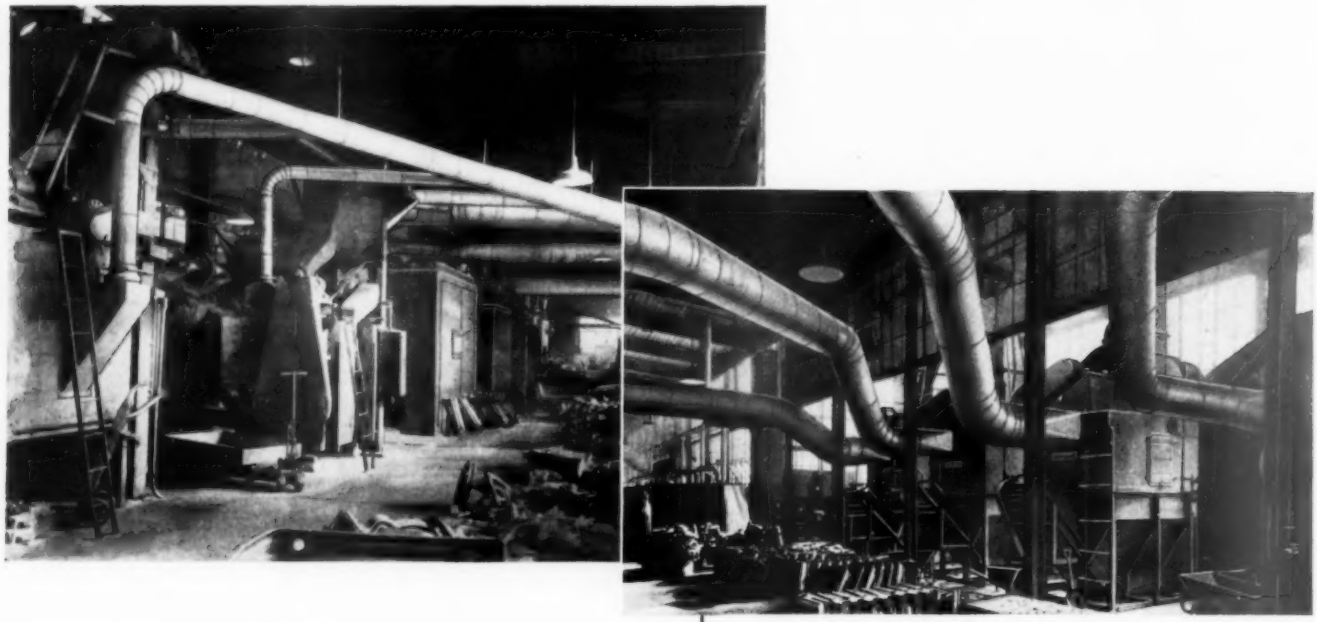
• Illustrated here is the No. 2 Simpson Mixer referred to as the "heart" of the sand conditioning system at the Banner Iron Works foundry, which has now had 3½ years of continuous operation without shut-down.

MANUFACTURER'S ASSOCIATION INC. FOUNDRY EQUIPMENT

NATIONAL ENGINEERING COMPANY

608 MACHINERY HALL BLDG. • CHICAGO 6, ILLINOIS

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd. Sydney, Australia



Pipe your *dust problems* to a Roto-Clone

Roto-Clone Precipitator Converts Abrasive Cleaning Into a Dust-Free Operation

BLAST rooms, blast cabinets, tumbling mills, airless blasting equipment — all are prime offenders when it comes to kicking up dust and all can be brought under control efficiently and economically with the installation of Roto-Clone Dust Control Equipment.

Illustrated above are four of the fifteen Type N Roto-Clone Hydro-static Precipitators that are handling 200,000 CFM from such dust producing operations in a large steel foundry. With the Type N Roto-Clone you get extremely high collection efficiency because dust separation is obtained by a combination of centrifugal force and thorough scrubbing of the air by water sprays.

You have no secondary dust disposal problem because material is collected wet and is simply ejected in sludge form. And with a constant air volume, as supplied by Roto-Clone, you obtain at all times effective removal of the fines which is so essential to maintaining the efficiency of the abrasive.

Abrasive cleaning is just one of many foundry operations where Roto-Clones have licked the dust problem permanently. Write today, for Roto-Clone Bulletin No. 270-A and name of nearest AAF representative.

AMERICAN AIR FILTER COMPANY, INC.
266 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF

ROTO-CLONE
DUST CONTROL EQUIPMENT

FREE!

ANSWERS TO YOUR GAS POROSITY PROBLEMS . . . . . *in Plain Foundry Language*

PRACTICAL STEPS for REDUCING GAS POROSITY in NON-FERROUS CASTINGS
By
A. E. St. John, Technical Advisor
Federated Metals Division
American Smelting and Refining Company
Federated METALS DIVISION
AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY • NEW YORK 5, NEW YORK
Federated M.D.

Every foundryman has had castings ruined by gas holes. It's money lost every time it happens...but it doesn't have to happen.

Federated research now makes it possible for you to reduce gas porosity by following a few simple foundry rules.

It's all explained in the free booklet pictured above...in non-technical language...recommended procedures for melting tin bronzes, for melting aluminum and silicon bronzes, for melting yellow brasses and manganese bronzes.

Clip the coupon NOW and learn how to cut gassing losses.

OTHER LITERATURE AVAILABLE FROM FEDERATED

Non-Ferrous Metals and Alloys	Test Bars
Aluminum Casting Alloys	Reprints of Technical Articles

Federated first in the non-ferrous field — FMD

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AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY • NEW YORK 5, NEW YORK

FEDERATED METALS DIVISION Dept. F JML-10, F-11-7
American Smelting and Refining Company
120 Broadway, New York 5, New York

Please send me a free copy of "Practical Steps for Reducing Gas Porosity in Non-Ferrous Castings". Also send copies of:

- ☐ Non-Ferrous Metals and Alloys Booklet
- ☐ Test Bars Booklet
- ☐ Aluminum Casting Alloys booklet
- ☐ Reprints of technical articles

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More grinding . . . done faster! That's the story of Simonds Abrasive high speed resinoid bonded grinding wheels . . . especially efficient for rough snagging work in foundries and steel mills where fast stock removal at reasonable cost is the prime consideration.

Also used for high speed abrasive cutting-off operations and many precision finishing jobs such as roll grinding, saw gumming, disc grinding and surfacing with segments.

Send for our Grinding Wheel Data Book for complete information and specify SIMONDS ABRASIVE to your nearest Simonds Abrasive Distributor.

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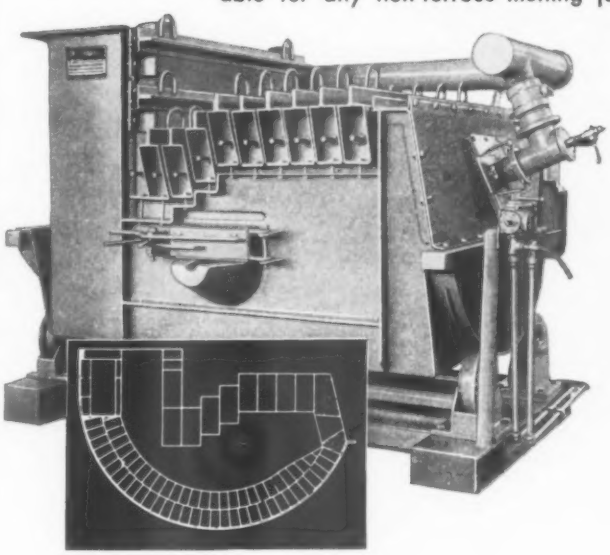
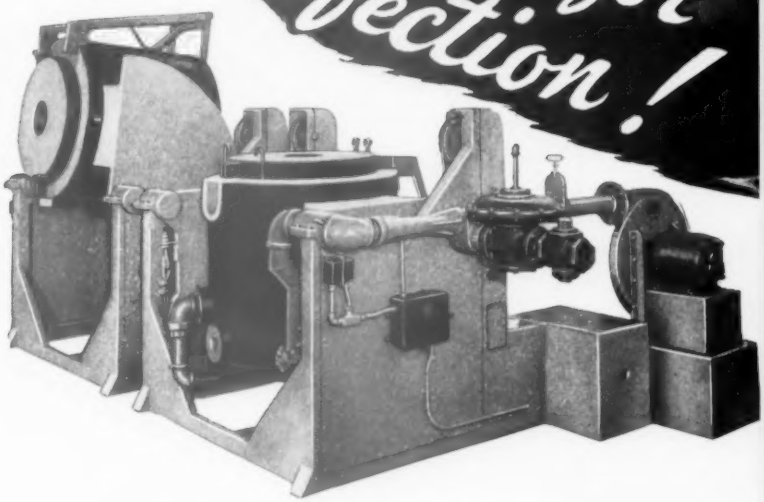
When you install a Stroman Furnace in your foundry, die casting or permanent mold plant you will be astounded at its extremely efficient operation . . . great economy in fuel consumption...speed of melting time and ease of handling. Stroman Furnaces have proved themselves to be the best available for any non-ferrous melting job. Write today for complete information





SKLENAR FURNACES

For melting Brass, Bronze or Aluminum, Sklenar Non-Crucible, Direct Fired, Reverberatory Melting Furnaces, are the fastest ever built. Their Design is unique. Metal is charged into a hopper which is also an exhaust from the combustion chamber. Here metal is preheated and melted at the throat of the hopper. Cold metal does not reach the molten bath. Charging is continuous. These furnaces will show fuel savings up to 40%; as the combustion chamber is heated by the same fuel that is used to melt the metal at the throat of the hopper. They are also very successful in the making of Grey Iron Castings. The furnace illustrated is the 1200 lb. (brass capacity) size, and is oil fired. Gas fire is also available. Full information upon request.

STROMAN MECHANICAL OR HYDRAULIC TILT CRUCIBLE MELTING FURNACES

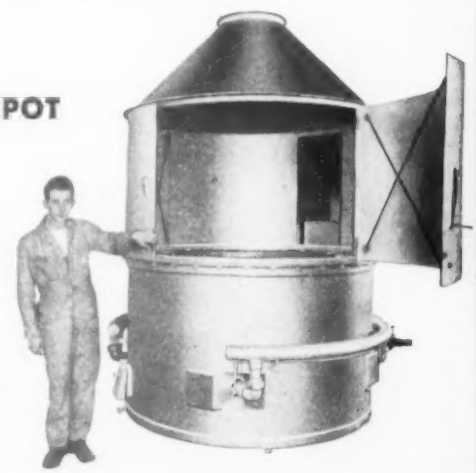
For Brass, Bronze, Aluminum and other non-ferrous metals. These Stroman Furnaces embody the famous Stationary Lip Pour Feature which assures a constant pouring arc, eliminating the necessity of moving the ladle at any time during a pour. They are excellent for use in permanent mold and die casting plants as well as any foundry. Their sturdy construction assures longest life, and their economical operation results in lowest production costs. Choice of oil or gas fire. Built in sizes to handle capacities from No. 125 to No. 400 crucible.

STROMAN CRUCIBLE STATIONARY MELTING FURNACES

For Brass, Bronze, Aluminum and other non-ferrous metals. Sturdy, efficient and featuring the Stroman Push-Back Cover these stationary furnaces are designed for peak production and greatest fuel economy. Oil or Gas Fire. Capacities from No. 20 to No. 400 crucible.

STROMAN IRON POT STATIONARY MELTING FURNACES

These furnaces are highly recommended as break down furnaces for zinc die casting plants. They also excel as aluminum holding furnaces. They can be supplied with or without hoods to exhaust fumes and heat. Their construction assures longest pot life and lowest fuel costs. Choice of manual or automatic controls and gas or oil fire. Capacities from 212 to 14,000 lbs. of zinc. Other metals in proportion.



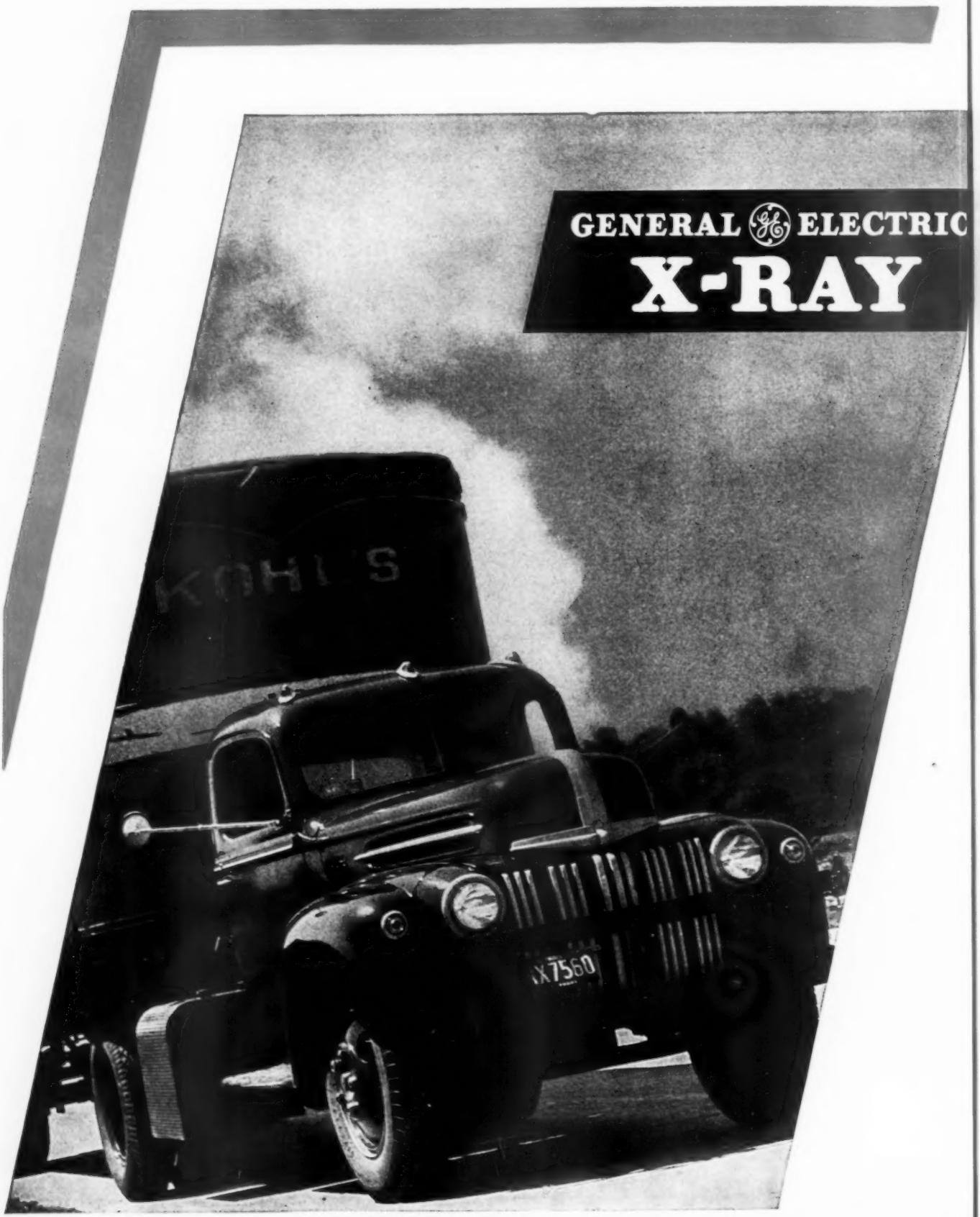
Write for Complete Information at Once

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

G-E X-RAY UNITS SAVE MONEY



FOR MOTOR TRUCK OPERATORS

TO THE MOTOR TRUCK OPERATOR rugged dependability, ease of operation, long life and economy are important factors. Heavy loads, hauled over long distances under all types of conditions, demand the utmost in unfailing reliance of equipment.

To the motor truck manufacturer, G-E X-Ray Industrial units on the job in works laboratories and inspection lines are his assurance of delivering to the operator a vehicle that measures up to these strict standards.

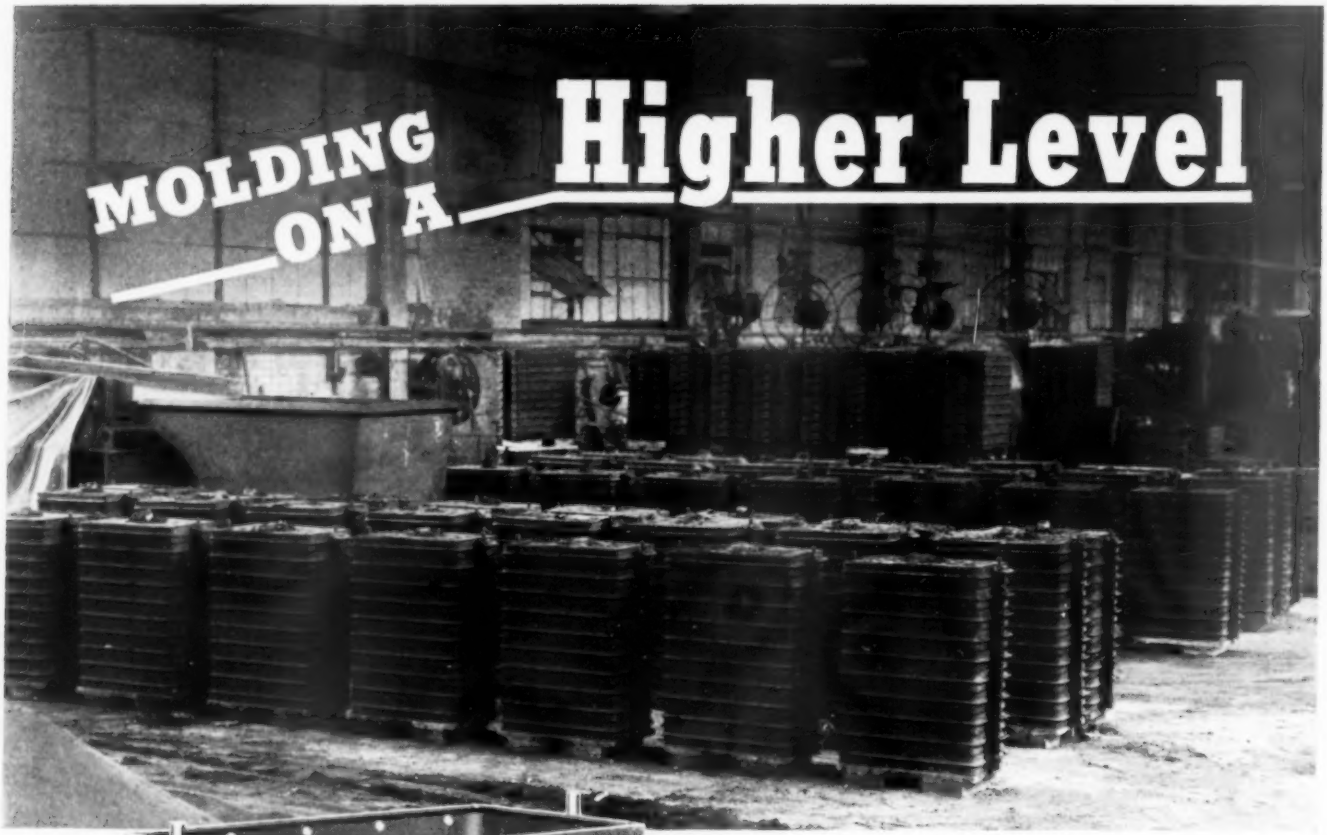
From engine crankshafts to spark plugs and mechanical and electrical assemblies, x-ray can reveal flaws, misalignments and defects that, unnoticed, might promote breakdowns—costly to the truck operator.

Casting and welding processes involve many variables that must be carefully controlled if quality products are to be produced. Failure to control these variables results in high rejection rates, expensive to the manufacturer and harmful to product reliability. X-ray control of foundry techniques eliminates the expense and limits of control imposed by sectioning trial castings. And production inspection of completed castings reveals, in sections accessible to the searching eye of x-ray, any defects that might impair finished product quality.

Parts subjected to severe stresses while in service are vastly improved by x-ray examination. Welded joints and seams can be thoroughly examined without resorting to destructive testing methods. Intricate assemblies of mechanical parts, where close tolerances and proper alignment are essential to operating efficiency, can be thoroughly checked by x-ray—insuring trouble free operation

Advantages such as these add up to real savings for both the manufacturer and the truck operator. Savings for the manufacturer because quality is high and rejects low, and savings for the operator as a result of increased dependability.

There are sound reasons why the majority of users of industrial x-ray equipment have selected General Electric X-Ray as their standard. Their experience will be a sound guide when considering x-ray as the solution to your problems. Why not do as they did? For complete information, without obligation, write or wire today to General Electric X-Ray Corporation, 175 W. Jackson Boulevard, Chicago 4, Illinois, Department 2627.



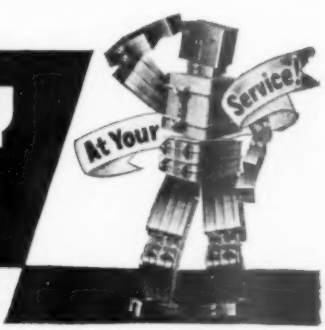
● Groups of 10 Sterling flask sections used for stack-molding in a Midwest Foundry.

WITH Sterling STACK-MOLDING FLASKS

Now — you can increase your foundry production 100% or more on certain types of castings by stack-molding with Sterling Steel Flasks. Molds are made in Flask sections stacked one above another, to a height of 10 or 12 sections, depending upon the depth.

Sterling steel flasks are tailor-made for stack molding operations. They easily withstand the terrific pressure used by high-speed molding machines. For faster, more efficient molding on a higher level, use Sterling special rolled steel flasks.

Sterling FOUNDRY FLASKS



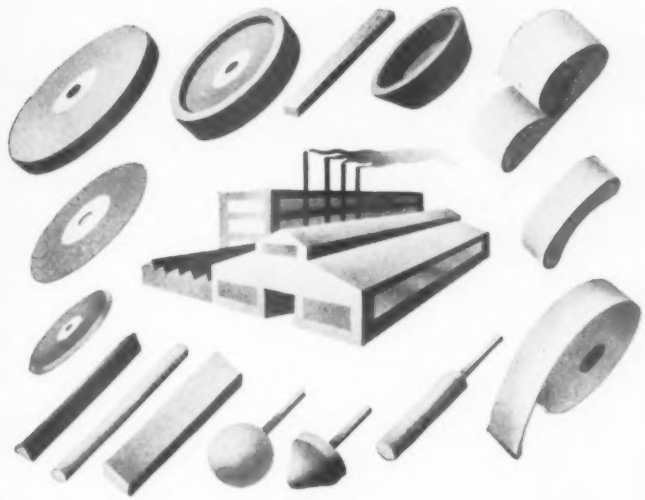
STERLING WHEELBARROW COMPANY • Milwaukee 14, Wis., U.S.A.

A 5264-1P

A BUYING GUIDE FOR ABRASIVES

POINT No. 9

COMPLETE LINE OF ABRASIVES



The Carborundum Company makes the only complete line of abrasives produced under one trade mark.

With industrial techniques utilizing a wider variety of different type abrasives, it is only logical that users turn to The Carborundum Company as the one primary source for all abrasive needs. Product quality is known and highly regarded. Specialized service on all abrasive problems and applications is covered by experienced representatives who are free to recommend the best abrasive products for your requirements. Satisfaction is assured. Of even more importance to many, responsibility is definitely fixed and undivided. For reasons such as these, there is an increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

A Good Rule for Good Grinding...CALL IN

CARBORUNDUM

TRADE MARK

- BONDED ABRASIVES
- COATED ABRASIVES
- ABRASIVE GRAINS AND FINISHING COMPOUNDS

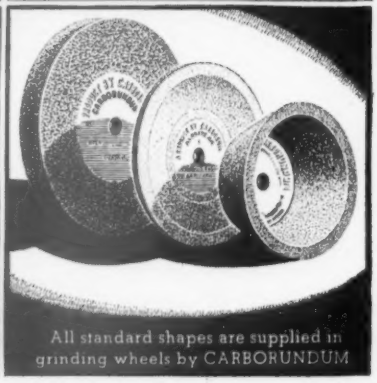
Specialized wheels by CARBORUNDUM for thread grinding

Diamond wheels to meet stiffer technical needs.

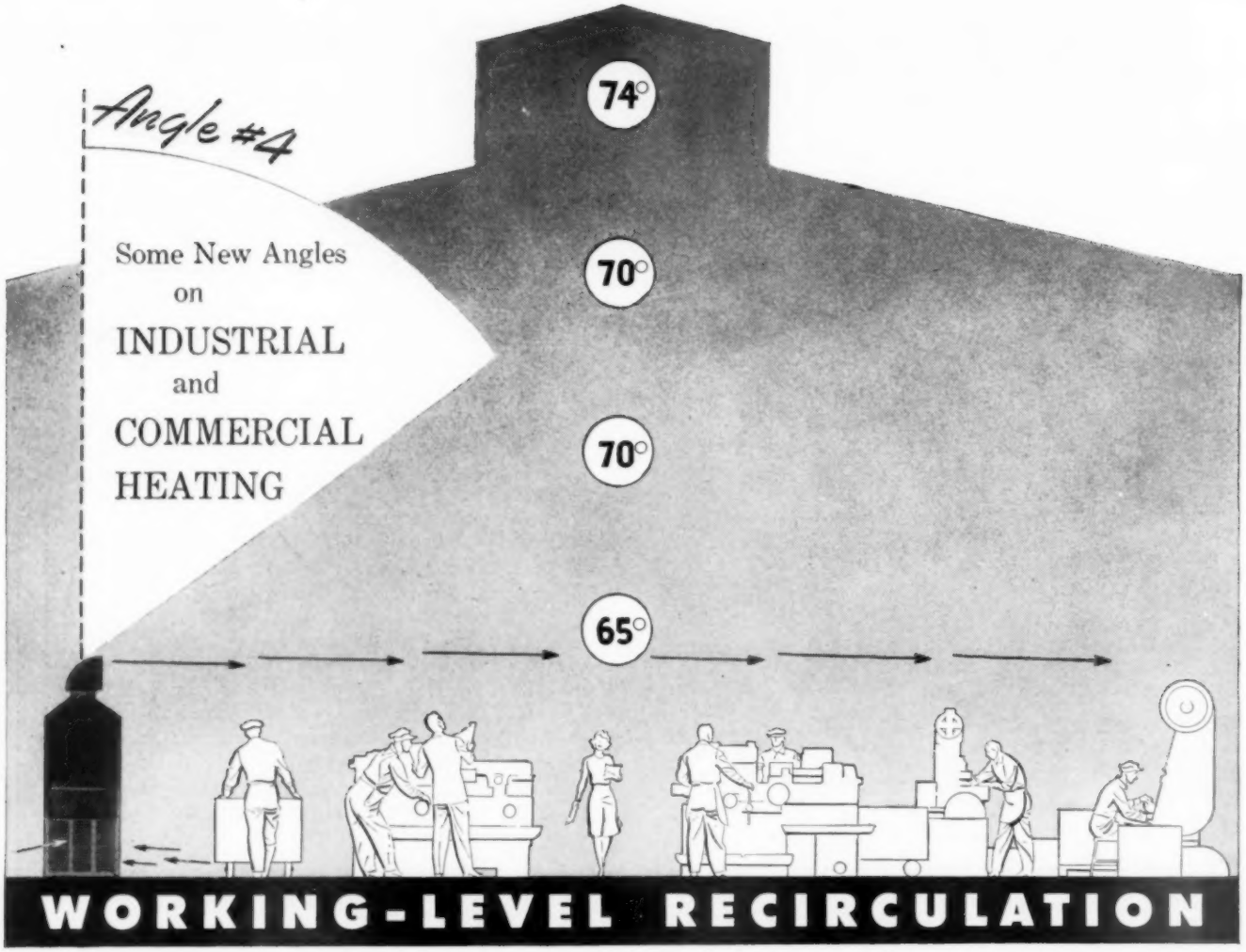
"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Cool-cutting green grit wheels for cemented carbide

A coated abrasive for every sanding and finishing condition



All standard shapes are supplied in grinding wheels by CARBORUNDUM



Actual tests with balloon-suspended thermometers in a building with 200,000 square feet of roof showed temperature differential between roof and working area to be only 9 degrees with Dravo Heaters. This is a big fuel-saving advantage when compared with other methods in which roof area temperatures are often 35 degrees higher than those at the working level.

The Dravo Counterflo Heater, oil or gas-fired, offers today's highest possible efficiency for open space heating. It recirculates warm air in the working level, thus minimizing the tendency of the heated air to rise and cause excessive heat losses through the roof. Under the Dravo method warm air is discharged above the heads of the workers and cool air is taken off the floor. This provides a thermostatically controlled comfort zone in the working level with no annoyance to workers.

In addition to saving fuel through low roof heat loss, the Dravo Heater is extremely economical in these respects . . . **Sustained efficiency of 80 to 85%—constantly getting more Btus from each gallon of oil or cubic foot of gas burned. — Lower initial cost compared with indirect heating systems. —Ease of installation . . . it is necessary only to provide power line, fuel line and stack. —No stand-by heat or specialized attendant is necessary. Heater operates only when thermostat dictates your requirements.**

Dravo Heaters are available in capacities ranging from 400,000 to 2,000,000 BTUs per hour output. The money-saving angles for Industrial and Commercial Heating with DRAVO COUNTERFLO DIRECT FIRED HEATERS are more fully described in Bulletin FN 516. Write Heating Section, DRAVO CORPORATION, 300 Penn Ave., Pittsburgh 22, Pa.

Dravo Counterflo Direct Fired Heaters are products of the Machinery Division.

DRAVO CORPORATION

PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK
DETROIT · WASHINGTON · ATLANTA · WILMINGTON

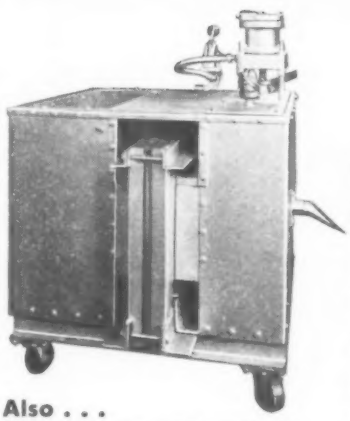
AT THE METAL SHOW . . .

the new "two chamber"

holding furnace

the LINDBERG-*Fisher*

ELECTRIC INDUCTION HOLDING FURNACE for aluminum



Also . . .
for melting soft metals
Stop at the Lindberg Booth (No. 720) and see a two chamber melting furnace in operation.

. . . with the same new features as its companion unit, the Lindberg-Fisher Electric Induction Melting Furnace.

The Lindberg-Fisher has these advantages!

Continuous ladling. This is possible because of the "two-chamber" design. Ingots or molten metal can be added to the receiving chamber within reasonable operating limits, without lowering ladling chamber temperature.

Cooler operation. Chambers carry insulated covers—protect operators from heat—minimize heat loss. Induction heating heats metal only, not the entire furnace. Large ladling chamber at convenient working height makes ladling easier.

Temperature flexibility. Furnace can be turned down to operate at a low overnight or weekend stand-by temperature. This eliminates lost "starting-up" time.

Doubles as melting furnace in shops requiring small melting capacity.

Accurate temperature control—so important in making sound castings—is provided for electronically.

Quick delivery. Available in 300, 500, and 1000 lb. holding capacities.

Write for additional information.

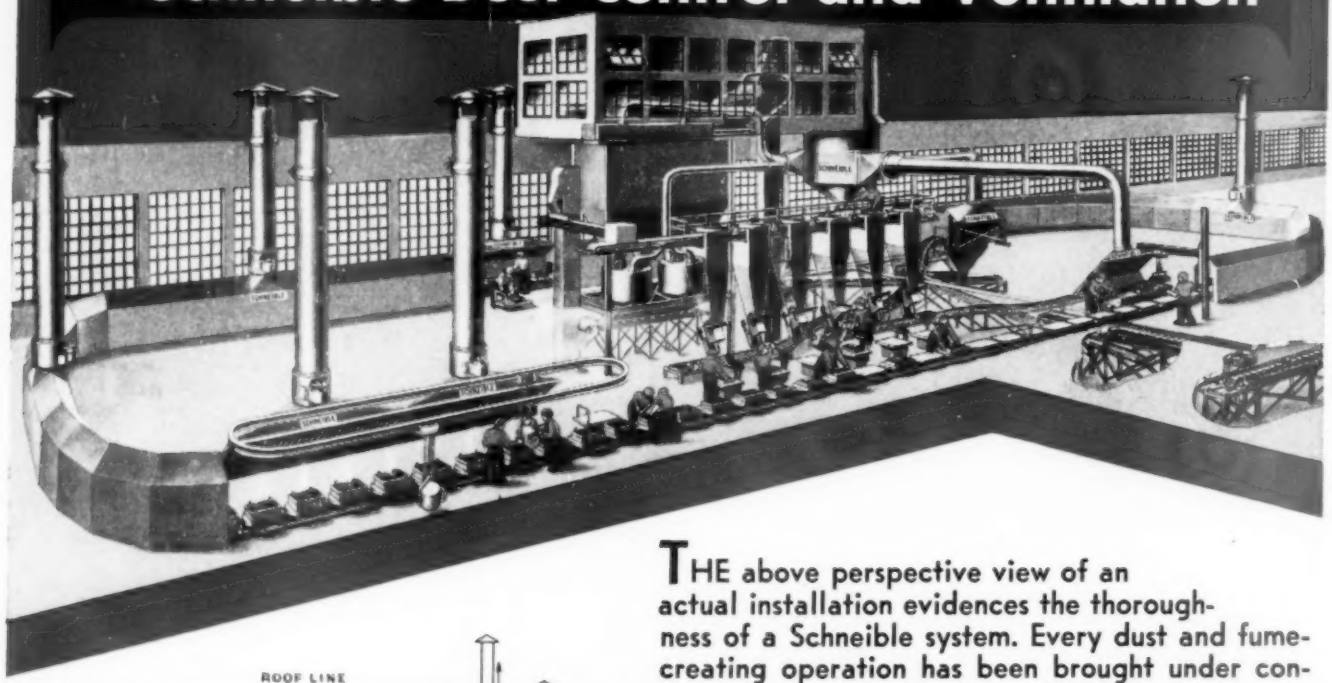
Now . . . a complete line of melting and holding furnaces—gas, oil, electric

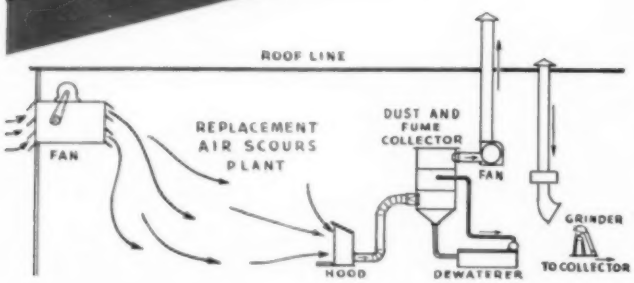
Fisher Furnaces

A DIVISION OF LINDBERG ENGINEERING CO.

2453 WEST HUBBARD STREET • CHICAGO 12, ILLINOIS

This Mold Conveyor Unit has Complete Schneible Dust Control and Ventilation





Schematic method of introducing replacement air in molding unit and cleaning room.

Mold cooling and dump-off ventilation; part of a Schneible System on snap flask work in a malleable iron foundry.

THE above perspective view of an actual installation evidences the thoroughness of a Schneible system. Every dust and fume-creating operation has been brought under control and adequate ventilation for all working zones has been provided.

The benefits of clean air, with resultant increased working efficiency and output, have been made permanent for the various production phases; moulding, pouring, cope shake-out, clamp removal, cooling, drag shake-out, sand conditioning and casting handling.

In this installation the Schneible Multi-Wash Collector—the heart of the Schneible System—is rendered most effective by the proper application of hoods and connections to all dust and fume-creating operations and the correctly engineered application of ventilation for providing replacement air.

Substantial dividends are being paid by Schneible Multi-Wash Systems in mold conveyor foundries, and in a long list of ferrous and nonferrous roller conveyor, floor and pit foundries, as well.

Send for Bulletin 47—"Schneible in the Foundry Industry."

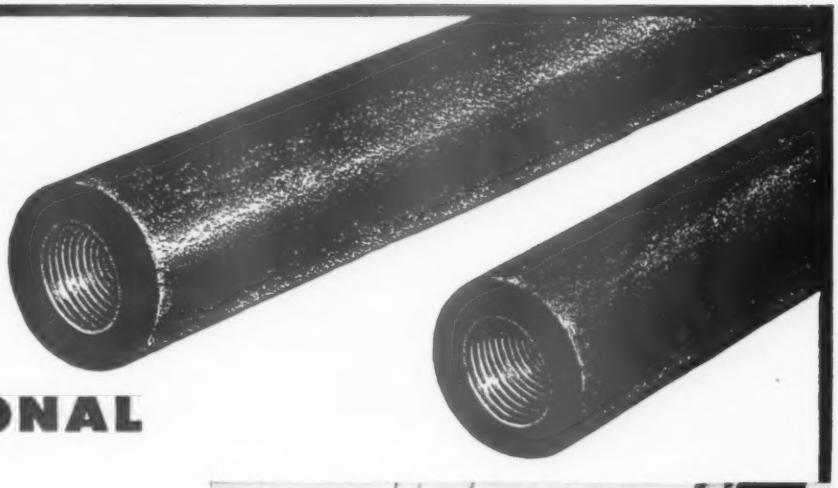
CLAUDE B. SCHNEIBLE CO.
2827 Twenty-Fifth St., Detroit 16, Mich.
Engineering Representatives in Principal Cities

MANUFACTURERS ASSOCIATION FOUNDRY EQUIPMENT

SCHNEIBLE

LIQUID-VAPOR INTIMATE CONTACT EQUIPMENT
for
DUST COLLECTION ABSORPTION
CONDENSATION AND TEMPERATURE REDUCTION

Back of the shovels that move mountains



INTERNATIONAL GRAPHITE ELECTRODES

The tough, hard-working steels used in mining and quarrying equipment to combat the relentless attack of hard, abrasive rock often outlast ordinary steels 10-to-1.

Makers of heavy-duty castings used in earth-moving machines—dipper teeth, bucket chains, crawler and conveyor parts—are regular users of International Graphite Electrodes.

In their products there can be no compromise with quality. And they have found, in actual electric furnace operation under a wide range of production requirements, that International Electrodes have what it takes to make the steels that can "take it"—the right physical, electrical and chemical properties in the right combination for their exacting needs.

For all-around satisfaction and economical performance, specify International the next time you buy electrodes. Write for details and prices today.

Specify INTERNATIONAL Graphite Electrodes for—Slow consumption—High current capacity—Low rate of oxidation—High thermal conductivity—High degree of purity—Consistently uniform properties and dimensions—Low cost per ton of production.

International Graphite & Electrode Corp.
SAINT MARYS, PA.

IGE

2547

Moistmeter

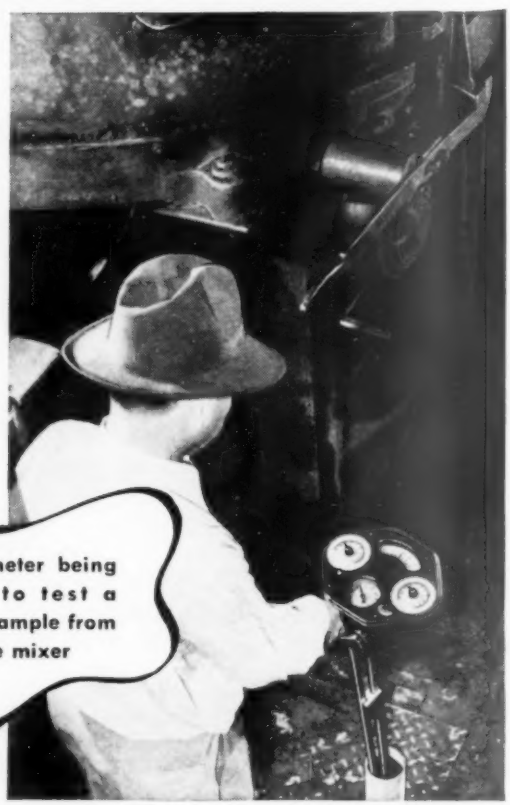
Fast • Portable • Accurate—Electric Moisture Tester FOR THE FOUNDRY

The Moistmeter is a versatile instrument that determines instantly the exact moisture percentage of either core or molding sand, on the floor or in the sand system.

It is ruggedly constructed, simple to operate and easy to carry around. Moisture readings can be taken at selected depths, from either a pint can or a large bin in just three seconds.

When you equip each sand preparation crew with the Moistmeter, you can control the moisture range within exactly specified limits with considerable improvement in your castings.

Moistmeter testing moisture of sand on the foundry floor.



Moistmeter being used to test a sand sample from the mixer

Write to Department "E"

HARRY W. DIETERT CO.

9330 ROSELAWN AVE., DETROIT 4, MICHIGAN

SAND • MOLD • MOISTURE • SULPHUR • CARBON

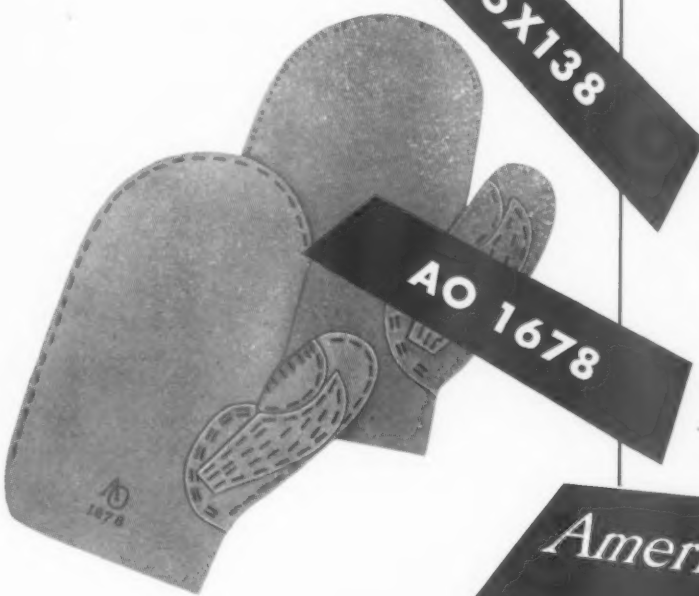
CONTROL

Almost as TOUGH as the Stock they Handle

Workers who handle castings and rough stock in foundries and elsewhere, give these AO steel stapled gloves, mittens and hand pads of chrome-tanned cowhide a "welcome hand." Like other products in the complete AO line of safety clothing, they provide the desired combination of maximum protection, comfort and serviceability. Call or write your nearest AO Safety Representatives for full particulars.

AO 1202

AO 5X138



AO 1678

GLOVE — A rugged product particularly suited for the wear and tear in steel mill handling of flying shears and rough steel scrap. Steel stapled features include leather thumb patch... index finger to crotch of thumb . . . second, third and fourth fingers to palm. All seams on face of glove steel sewed. 4" gauntlet.

MITTEN — Reversible — for right or left hand for double wear. Steel-stapled leather patch on both sides of thumb. All seams steel sewed.

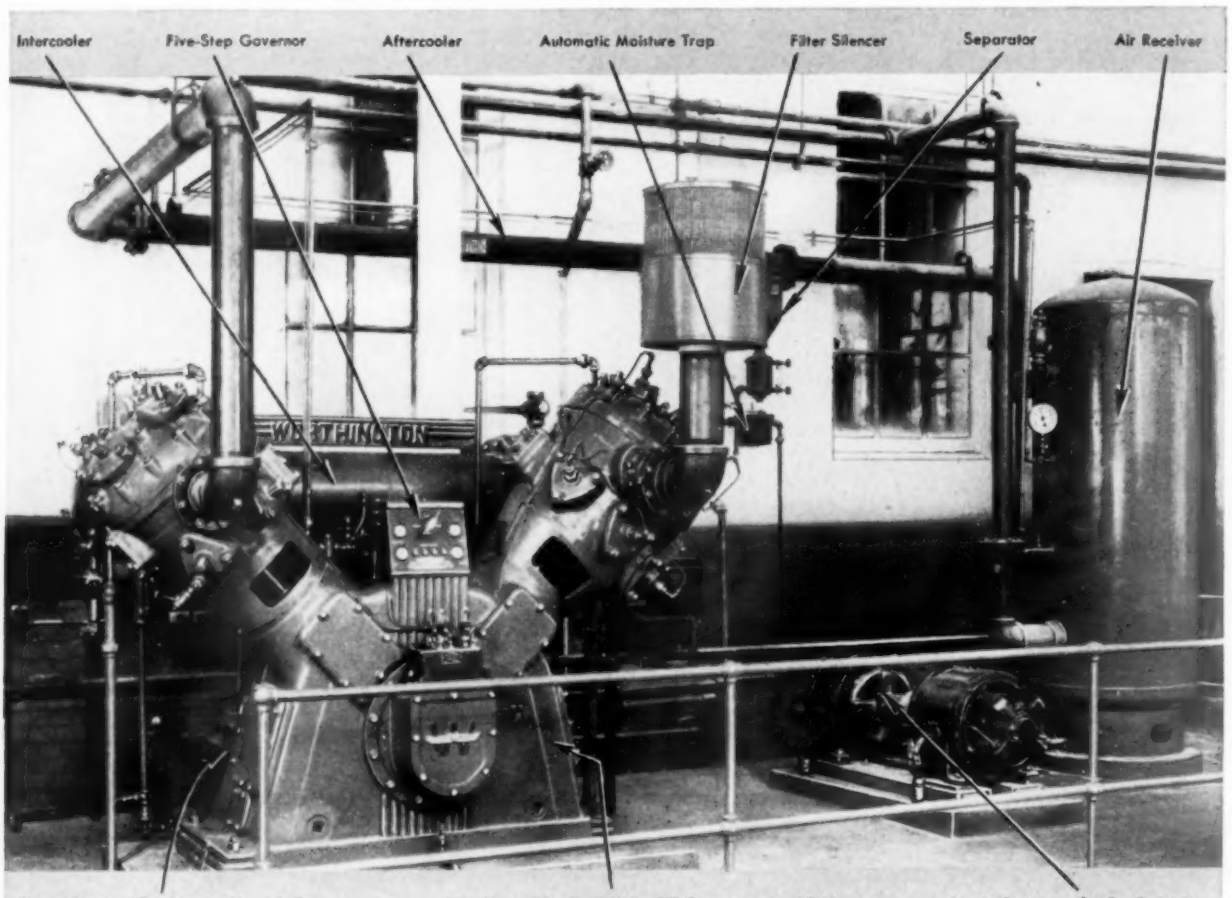
HAND PAD — Another "made for the job" product. Ideal for handling steel bars and rough stock where an open back construction is desired. Fully protected thumb. Steel-stapled leather patch over palm and thumb, steel-reinforced diagonally for full protection on wearing surfaces.

American Optical
COMPANY
Safety Division

SOUTHBRIDGE, MASS. • BRANCHES IN PRINCIPAL CITIES

WORTHINGTON ALL THE WAY!

A Modern, Efficient Compressed Air Plant...Engineered Entirely By Worthington



Here's every element of an up-to-date compressed air plant in surprisingly little space! Note, too, the Worthington YC Compressor's small, inexpensive foundation. Then remember that the YC needs no alignment or erecting engineer and you'll realize you're looking at a big reduction in installation costs.

Plus HIDDEN Advantages Like These:

Power factor improvement from the synchronous motor and quick-acting, 5-step governor . . . completely automatic control for the entire system, as in the largest compressed air plants . . . advanced YC design that assures a longer-lived, cooler and smoother running compressor, with maintenance and operating expenses at their lowest.

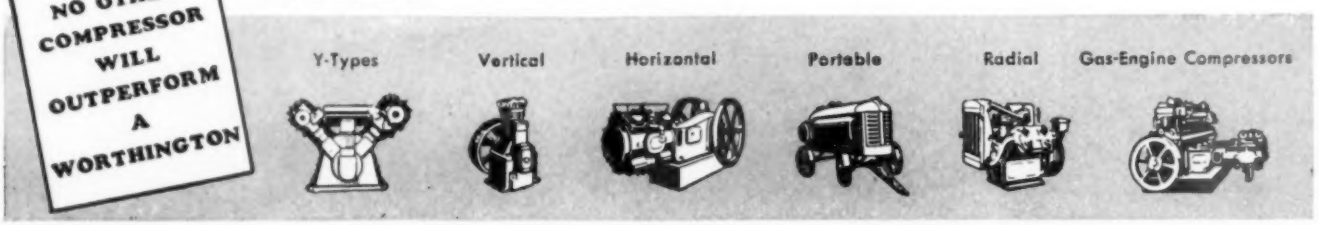
Write for further facts that prove *there's more worth in Worthington.* Bulletin L-667-B1A tells the complete story of how YC Compressors can cut your air costs. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

K7-16

WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

*Reg. U. S. Pat. Off.



Do these false beliefs keep you from converting to aluminum?

(Below are *4 misstatements* commonly applied to aluminum. Have *you* made any of them?)

1. "Aluminum is not readily adaptable to my product"

Fact: Kaiser Aluminum comes in a wide range of alloys to meet every type of manufacturing operation, and can be formed, drawn, spun, brazed or joined. It can be painted or polished, or finished in almost any way you choose. To select the alloy specifically suited to your requirements, simply call on a Permanente Metals' engineer.

2. "Aluminum costs too much"

Fact: While prices of other materials have steadily risen, aluminum is now *at the lowest price in history.* Figured *not* on a per pound basis, but on *unit cost,* aluminum prices (which include freight charges) compare favorably with those of any other metal or material. In addition, savings made on handling, finishing and shipping cut costs substantially.

3. "My competitors aren't converting. Why should I?"

Fact: Scores of manufacturers are speeding their products to market — by converting to aluminum. That's true of makers of general appliances, residential buildings, air conditioning units, heating and ventilating ducts, garage doors and window frames, office appliances and cabinets . . . *plus dozens more.* Their experience can help *you.*

4. "I can't be sure of a steady, long-term supply"

Fact: This is *especially* wrong *today.* For Permanente Metals now offers you a new source of aluminum . . . Kaiser Aluminum. In but a single year of operation Permanente Metals' mammoth aluminum plants produced 175 million pounds of plate, sheet, and strip aluminum. Almost as much as the entire industry produced in the most productive year before the war.

To the above facts add these . . .

Aluminum's resistance to corrosion cannot be matched. Nor can its strength per pound — it can give you the strength of steel at one-third the weight.

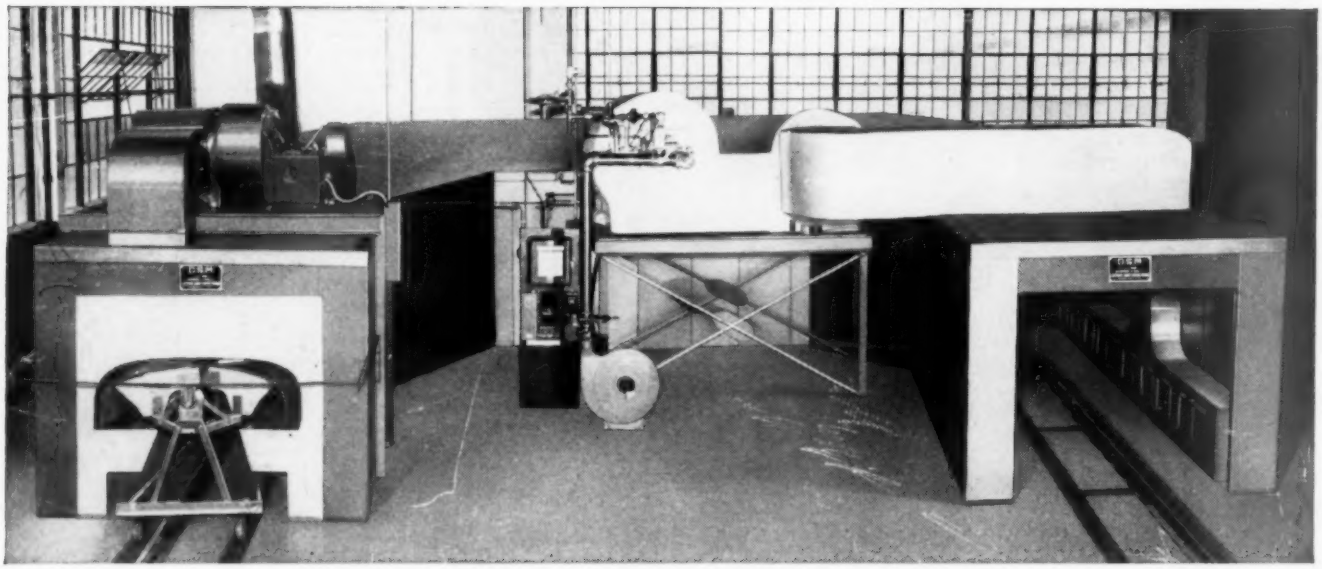
Aluminum's appearance can put an extra sparkle of *saleability* on many products, giving them a competitive edge.

In the light of all these *facts,* can you afford NOT to investigate the possibility of converting to aluminum? Call any Permanente Metals' office and an experienced sales engineer will be on the job, for *you!*

Ready to serve you—today . . . **Kaiser Aluminum**

a Permanente Metals product

DISTRIBUTED BY PERMANENTE PRODUCTS COMPANY, KAISER BLDG., OAKLAND, CALIFORNIA . . . WITH OFFICES IN: Seattle, Wash. Oakland, Calif. Los Angeles, Calif. Dallas, Texas Wichita, Kan. Kansas City, Mo. St. Louis, Mo. Atlanta, Ga. Minneapolis, Minn. Milwaukee, Wis. Chicago, Ill. Cincinnati, Ohio Cleveland, Ohio Detroit, Mich. Boston, Mass. Hartford, Conn. Buffalo, N. Y. New York City, N. Y. Philadelphia, Pa. Washington, D. C.



Automobile Hood Touch-up Oven—Hoods or other automotive parts. Custom built to fit any contour or space available.

DSM

CROSS FLOW CIRCULATION
FOR ACTUAL SURFACE CONTACT

Properly applied, DSM designed CROSS FLOW heating systems effects a gentle wiping action on all surfaces—sides —tops—bottoms—of your product, to be dried or processed. Resulting in speedier baking and a more uniform product.

WE WANT TO BUILD ***YOUR*** *OVENS*

PLANT ENGINEERING: *Consulting assistance in plant layout to coordinate departmental operations, our experience dated from 1917 in this field.*

Such plant layout may be based on increasing production beyond present capacity, or it may be a rearrangement in this post-war period when operations are conducted under a new set of conditions.

MOTOR CLEANING EQUIPMENT: *Washing machines for cleaning teardowns. Kerosene spray or similar solvent usually used as the cleaning medium.*

FORMED COWLINGS, PANELS, ETC.: *To your specifications, and of light metal alloys as required. Weldments and brazed assemblies may be under controlled atmosphere*

PILOT EQUIPMENT: *Sample size equipment for development of heavy equipment.*

VERTICAL CORE BAKING OVENS • CONTINUOUS HORIZONTAL BAKING OVENS • BATCH TYPE CABINET OVENS • DRAWER OVENS

DETROIT SHEET METAL WORKS
1270 OAKMAN BOULEVARD, DETROIT 6, MICHIGAN

Eastern Representative: R. W. Richards Co.
P.O. Box 358
Ridgewood, New Jersey

METAL FINISHING EQUIPMENT *by*

DETROIT SHEET METAL WORKS

1306 Oakman Boulevard DETROIT -6- MICHIGAN

DSM INDUSTRIAL OVEN
DESIGNED AND BUILT BY DETROIT SHEET METAL WORKS

PAINT SPRAY HEATING, VENTILATING, COOLING, DRYING, HUMIDIFYING SYSTEMS, JAPANNING AND INDUSTRIAL OVENS, INDUSTRIAL WASHING MACHINES

Appearance of oxygen-fuel flame in open hearth

Oxygen speeds open hearth combustion

Oxygen once again reveals the productive power it holds for mankind. Today it starts to unfold vast new opportunities in the Steel Industry. It may, in fact, change present day standards of open hearth production.

This new combustion technique, employing the oxygenated fuel flame, reduces meltdown time by accelerating the heat input rate. Airco has played an important role in initiating this development, and in assisting the steel industry in its research efforts. Airco is continuing to cooperate in working out specific application problems.

Cooperative research and development such as this exemplifies Airco's continuing effort to provide time-saving, product-improving tools and techniques for ALL industry. The facilities of our Technical Sales Division are available to you in applying Airco processes and products to the solution of your problems.

* * *

If you are interested in obtaining further information, please address: Technical Sales Division, Air Reduction, 60 East 42nd Street, New York 17, N. Y.

AIRCO **AIR REDUCTION**

Offices in All Principal Cities

Originators of Modern Oxyacetylene Flame and Electric Arc Methods for ALL Industry

How Scientific Melting *Reduces Costs*

"WHAT can you recommend that will help us reduce the cost (or improve the quality) of our hot metal?" This is the question Whiting Foundry Engineers are most frequently asked.

Their answers, of course, are different for every foundry and can only be given after careful analysis of individual plant conditions and requirements... metal specifications, pouring temperatures, daily tonnage, plant layout and facilities, available labor supervision, and many other factors.

Sometimes their answer leads to increased mechanization, sometimes to more efficient melting equipment and procedures, sometimes to duplexing or triplexing, to improvements in plant layout, etc.

Whatever your individual problem, Whiting Engineers are qualified by long and diversified experience to help you find the answer. Their recommendations are entirely unbiased—because they have no ax to grind! Whiting supplies ALL types of charge make-up and melting equipment.

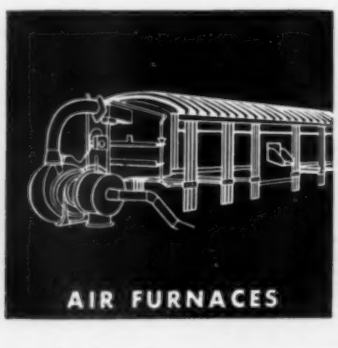
Would you like to have the assistance of these practical foundrymen? Write Whiting today.

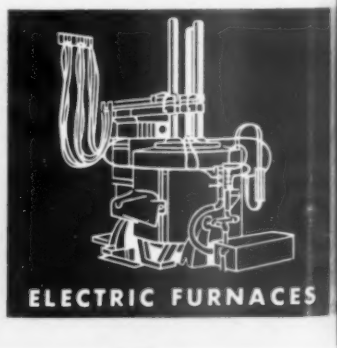
WHITING
CORPORATION

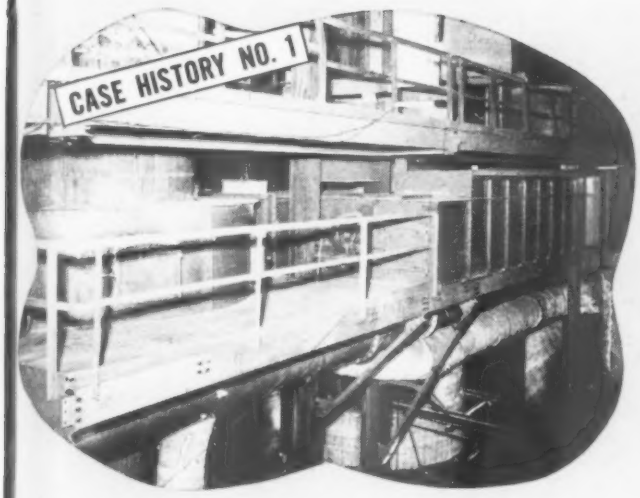
15607 Lathrop Ave., Harvey, Illinois

Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.

Whiting Melting Equipment

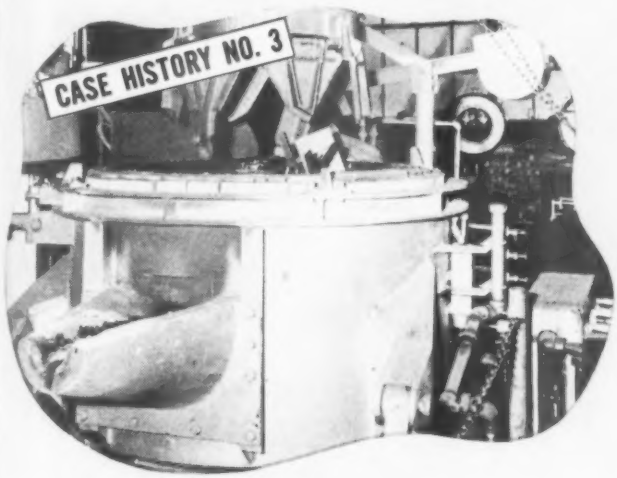






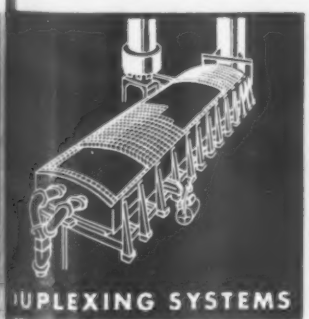
Following an efficiency study in an automotive foundry, Whiting recommended the use of Hot Blast. Results: Better control of cupola operation; and a saving of over thirty per cent (30%) on coke!

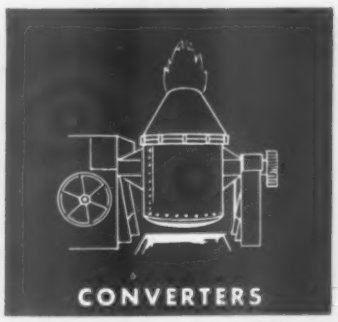
A farm equipment foundry used twenty-four men for charging—loading by hand in the yard, transporting to the cupolas, and hand charging. Whiting Engineers recommended a completely mechanized charging system. Results: Better control of composition and distribution of cupola charges; and the entire charging operation (transport, make-up, and charging) handled by three men (instead of 24).

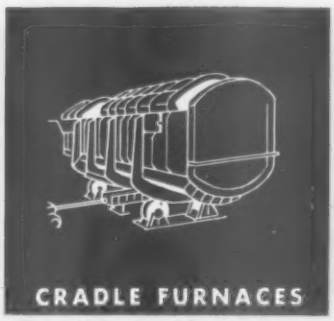


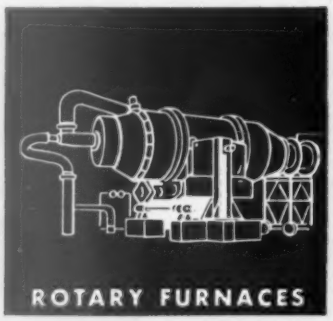
An electric steel foundry that had been using an old style electric furnace accepted the recommendations of Whiting Engineers and installed a new Hydro-Arc top charge Electric Furnace. Results: Important savings in both electric power and electrode costs; a reduction in the amount of labor required and notably improved working conditions.

A pipe and fittings foundry was producing two heats of air furnace malleable per day, which required floor space for a full half day's molds. Whiting Engineers recommended cupola to air furnace duplexing. This permitted continuous pouring and continuous molding. Results: Increased output; savings in labor; more economical use of floor space; elimination of overtime.









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CUT OFF WHEELS

WHEN TIME IS SHORT AND THE JOB IS LONG YOU CAN USE THEM TO GOOD ADVANTAGE . . .

For extreme accuracy and economical performance, Sterling Cut Off Wheels are ideal. They will readily cut unannealed alloy steels to limits within 0.005-inch. Ends are smooth, making a second grinding operation unnecessary. For a quicker job, well done, specify Sterling and be certain of success. Our engineers will gladly supply specifications suitable for solving your cut off problem. Write anytime!

"THE WHEELS of INDUSTRY"

• Send for Sterling's folder on cut off operations. It's free!

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THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

RE:

Aluminum

Three new publications resulting from A. R. I. research; three new factors in industrial progress:

1. **"Manual of Aluminum Casting Alloys"**—For designers, users, and producers of castings (mailed free upon request on your company letterhead.)
2. **"A. R. I. Yield Strength Calculator"**—For physical testing laboratories. ($1.00 each, postpaid.)
3. **"Analytical Methods for Aluminum Alloys"**—For analytical laboratories. In preparation—ready for distribution about November 1st. Price to be announced later.

Address inquiries and requests to Aluminum Research Institute.

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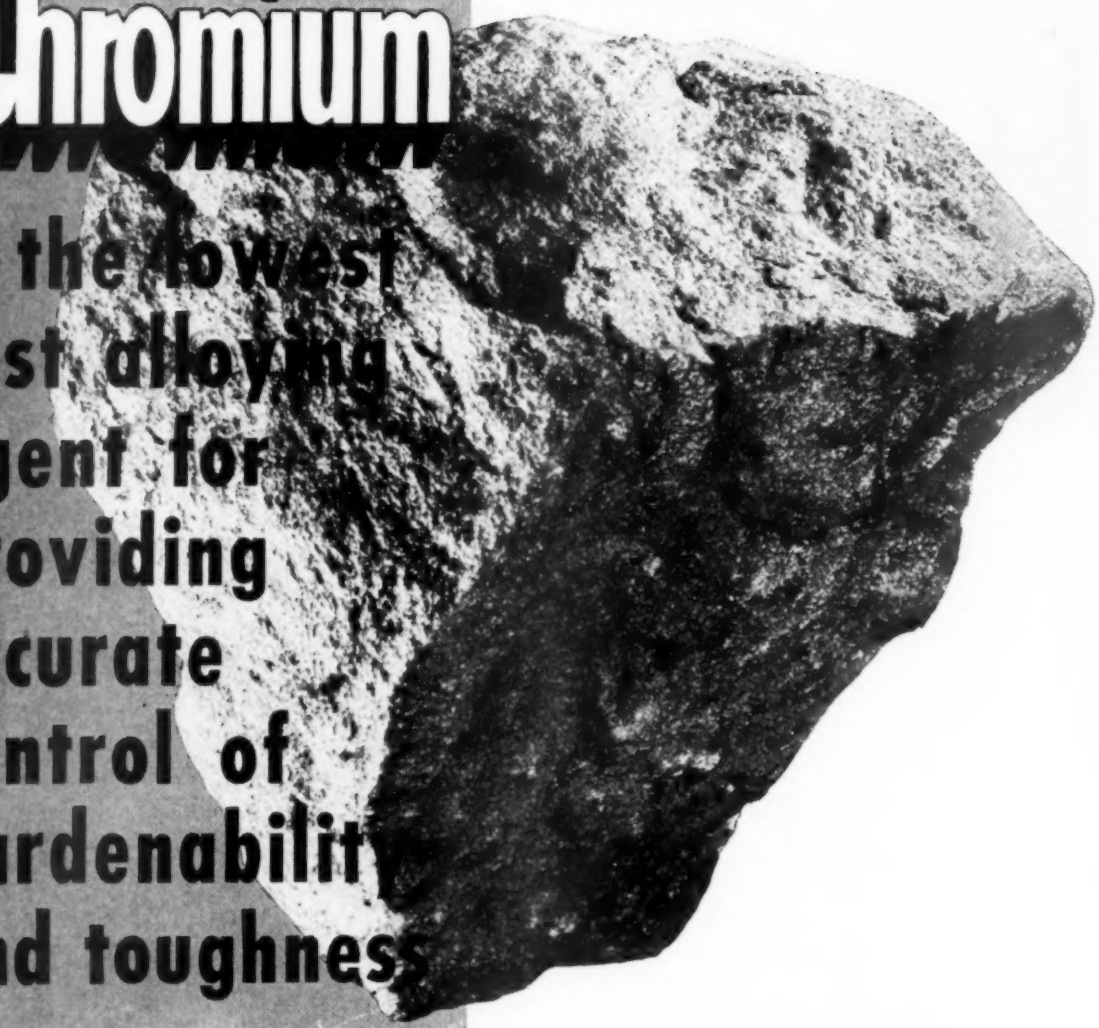
. . . a major supplier of **STANDARD H C FERRO CHROME**

Chromium



is the lowest cost alloying agent for providing accurate control of hardenability and toughness

FERRO SILICON 50%, 75%, 85%, 90%
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BOROSIL • SIMANAL
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PHILO RAINER

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Ohio Ferro-Alloys Corporation
Canton, Ohio
Chicago Detroit Pittsburgh San Francisco Tacoma

BEFORE: Machine tool casting as shaken from flask and placed on rotative table in Hydro-Sand Blast Room

AFTER: Same casting after a 15-minute Hydro-Sand Blast treatment

CORES REMOVED . . . CASTINGS CLEANED *in the same operation*

FASTER, CHEAPER, SAFER

Another Advance by Pangborn

A new wet blast machine that eliminates the necessity for moving castings from core knockout to blast room is the latest Pangborn development contributing to more profitable foundry operation.

All in one compact, flood-lighted room, cores are removed and castings cleaned (inside and out) by a blast of sand and water, controlled from the *outside.*

In addition to saving the cost of material handling, an important advantage is the improvement in working conditions. A dusty and dirty operation is confined to a single easily-cleaned enclosure, the operator handles the turret gun at long range, and hazards are eliminated. Core sand is reclaimed and core rods are removed without sledge damage—for further savings.

For more information on HYDRO-SAND BLAST AND CORE KNOCKOUT, write to Pangborn, *world's largest manufacturer of blast cleaning and dust control equipment.* Pangborn Corporation, 1300 Pangborn Boulevard, Hagerstown, Maryland.

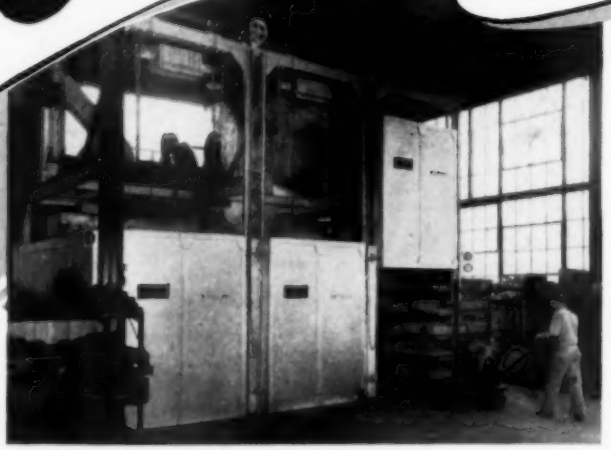
Pangborn

PANGBORN CORPORATION, HAGERSTOWN, MARYLAND

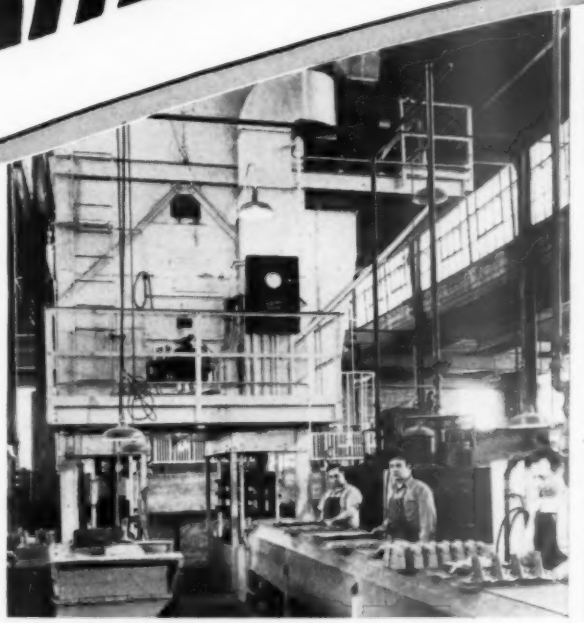
BLAST CLEANS CHEAPER

with the right equipment for every job

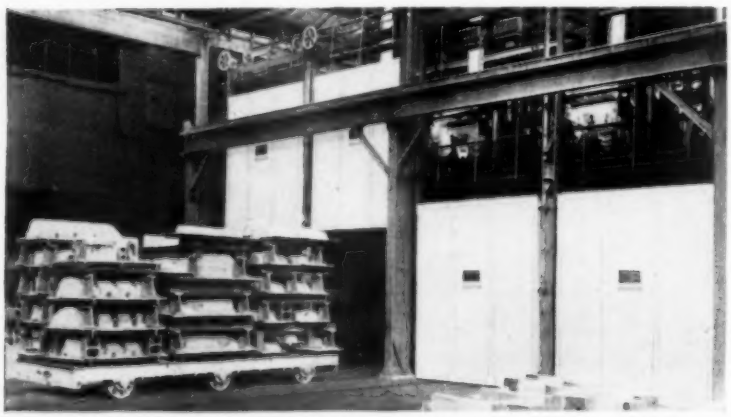
COLEMAN OVENS AHEAD FOR



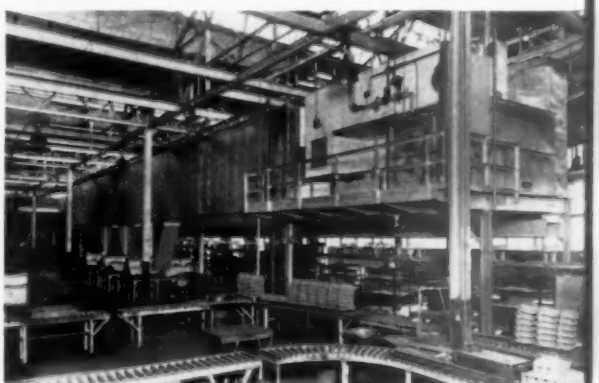
COLEMAN TRANSRACK OVENS. For operation with portable racks to reduce handling. Single or double rack capacity per compartment.



COLEMAN TOWER OVENS. For high speed production at lowest labor cost Patented Open Center permits loading from inside and outside the Tower to provide greater accessibility and loading speed.



COLEMAN CAR TYPE OVENS. For baking large cores or drying molds. Most of the large core and mold ovens in operation in every class of foundry production are Coleman Car Type Ovens.



COLEMAN HORIZONTAL OVERHEAD CONVEYOR OVENS. For production foundries, to serve large numbers of coremakers for specialized conditions.

COLEMAN CORE and MOLD OVENS

The FOUNDRY E
CLEVELAND 13, O H

BUILDERS OF COLEMAN AN

OVER 40 YEARS

The Widest Range of Foundry Ovens Built by World's Oldest and Largest Foundry Oven Specialists

AHEAD—IN DEPENDABLE BAKING. Coleman Ovens eliminate the uncertainties in core baking and mold drying — protect you against rejects and make-overs.

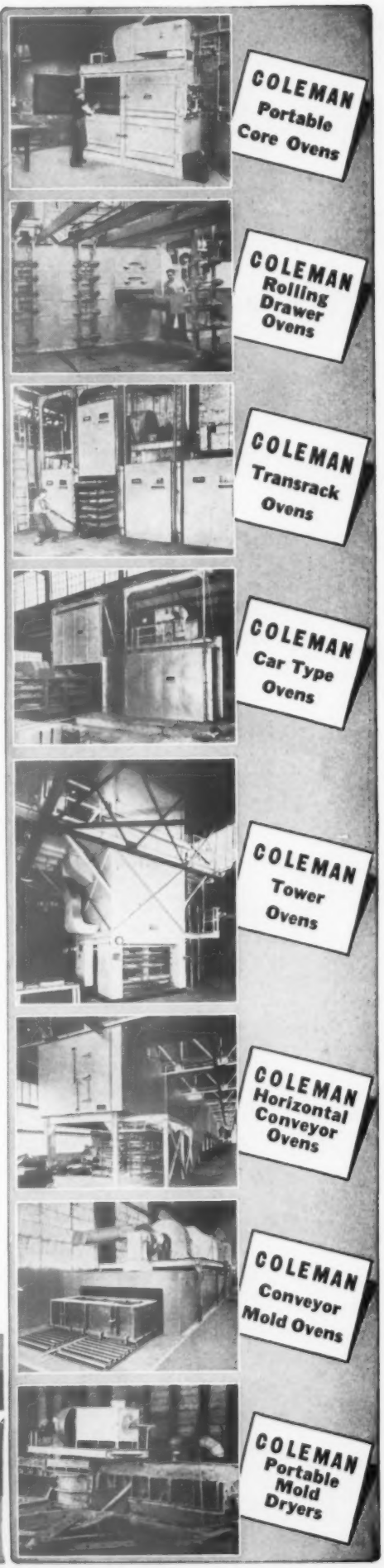
AHEAD—IN LABOR SAVING. Efficient and modern mechanical designs reduce handling and other indirect labor to a mere fraction.

AHEAD—IN HEAVY DUTY CONSTRUCTION. Long dependable service assured under the most severe operating conditions with minimum labor for maintenance.

AHEAD—IN KNOW-HOW. Experience gained from more than 9,000 successful installations of all types covering every class of foundry work — gray iron, malleable, steel, alloy, magnesium, etc.

AHEAD—IN FUEL ECONOMY. Coleman Ovens can be furnished with a heating system to use whichever fuel is most economically obtainable in your district — gas, oil, electricity, stoker or powdered coal, etc.

Write for Folio of Bulletins



RY EQUIPMENT Company

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MEMBER FOUNDRY EQUIPMENT

IAN AND SWARTWOUT OVENS

CONVINCING EVIDENCE OF *G-IRON SUPERIORITY

Photomicrograph 100 diam. unetched. Regular pig—Silicon 2.40, Total Carbon 4.04.

Photomicrograph 1000 diam. etched. Regular pig—Silicon 2.40, Total Carbon 4.04.

Photomicrograph 100 diam. unetched. G-Iron pig—Silicon 2.35, Total Carbon 4.10.

Photomicrograph 1000 diam. etched. G-Iron pig—Silicon 2.35, Total Carbon 4.10.

Examine closely this photograph of two pigs. Notice the refinement of grain structure of the *G-Iron pig (right) as compared with the regular pig (left).

Now inspect the photomicrographs which correspond with each pig...*convincing evidence of *G-Iron superiority.*

*G-Iron is graphitized pig iron. A patented blast furnace process refines the grain structure of the pig—and this refinement follows through to the final casting. The finely distributed graphite increases fluidity and reduces chill in thin sections—improves machinability and helps to overcome shrinkage and porosity between thin and heavy sections.

TONAWANDA for sound Castings

TONAWANDA IRON CORPORATION

NORTH TONAWANDA, N. Y.

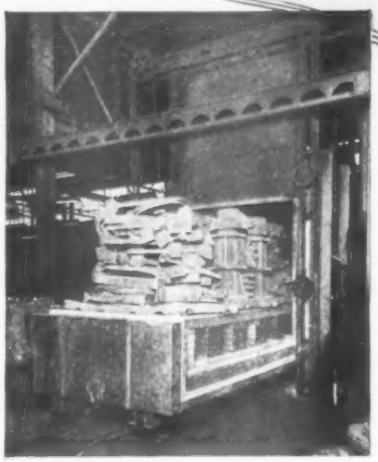
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

"Just like adding a New Furnace"

WHAT A COMPLETE INSTALLATION OF B&W REFRACTORIES DID FOR THIS PLANT

	STANDARD FIREBRICK LINING	B & W LINING	CHANGE
Heats per Month	21	41	+ 95%
Gallons oil per Heat	194.7	143.5	— 26%

Furnace relined with B&W Insulating Firebrick: Sidewalls and end—9" B&W K-26 I.F.B. backed with 4½" B&W K-16 I.F.B.; Arch—9" B&W K-26 I.F.B. backed with 2½" B&W K-16 I.F.B. Car lined with 8" B&W K-22 Insulating Concrete, topped with B&W Junior Firebrick.



"Just like adding a new furnace," was the operator's comment when he saw the improvement in production and fuel efficiency obtained by relining his furnace with B&W Refractories.

From 1942, when Pelton Steel Castings Co. built this furnace, various combinations of refractories were used without success. Standard firebrick failed and required frequent repairs.

But . . . early in 1946, the furnace was completely relined with B&W Refractories. Since then, maintenance has been negligible. And—as the above production record shows—*production has practically doubled,* while fuel consumption per heat is substantially lower.

This is just one of many typical case histories that demonstrate how B&W Refractories are increasing production and reducing costs in all types of industries.

R-292

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

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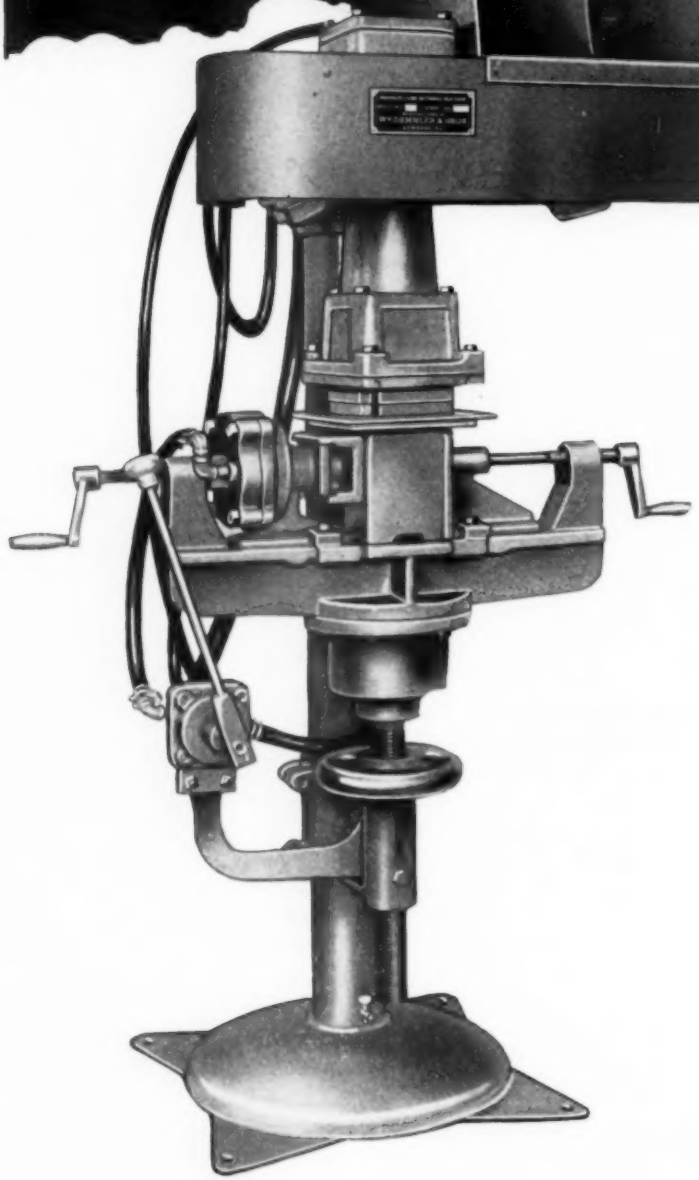
WHAT DO YOU WANT IN A SMALL CORE BLOWER?



1. First of all, dependability—

The new DEMMLER No. *55*, like all DEMMLER core blowers, has earned its reputation for quality and dependability through performance. Ask any foundryman who uses these machines what he thinks about DEMMLER dependability. The blow valve is a trouble-free diaphragm type valve, and the maintenance item is reduced to a minimum. Here is a *real* core blower—a machine that will still be on the job years from now, giving perfect satisfaction because it is built to last!

2. Rapid Production—

A single hand valve operates both vertical and horizontal core box clamps and blows the core—all in 3 seconds!

To fill the sand magazine, just push the magazine over to register with the sand supply hopper. There are quick, easy adjustments for raising the table and moving the chuck jaws.

The sand magazine has sliding blow plates to speed up job changes.

3. Ease of operation—

No previous core making experience or special skill is required, and girl operators may be used. Sand magazine and carriage are light aluminum castings, mounted on ball bearing rollers.

The DEMMLER No. 55 is *your* dependable, yet economical, solution to the rapid production of high quality small cores. It's popular because it's a profitable machine to own.

The New DEMMLER No. 55

Will accommodate core boxes 11" long

—handle cores weighing up to 3½ pounds.

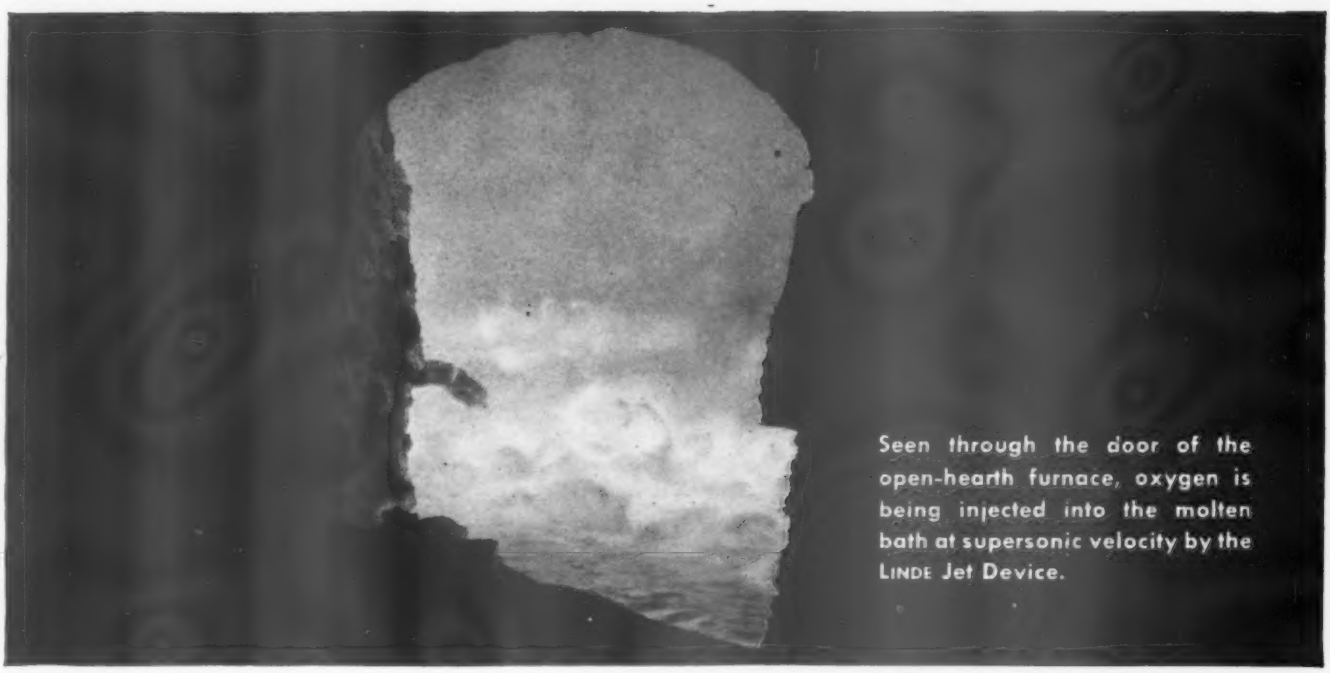
Sizes of available sand magazines: 4 1/2" x 9 1/2" opening at bottom
6" x 8" " " "
10" diameter " " "

Weight of machine . . . . . 550 pounds

Wm. Demmler & Bros.

KEWANEE, ILLINOIS

Send for Illustrated Specification Sheet



Seen through the door of the open-hearth furnace, oxygen is being injected into the molten bath at supersonic velocity by the LINDE Jet Device.

What's the Story on OXYGEN in Steel-Making Furnaces?

ONLY THE FIRST CHAPTERS OF THIS STORY have yet been written—promising though they appear. To date LINDE has co-operated with steel companies in obtaining data on more than 6,000 heats in 34 furnace shops as a part of an experimental program on oxygen use in steel-making furnaces. From all these data the basic fact stands out that the periods of scrap melt-down and of refining can both be shortened appreciably.

Already credited to LINDE are the development of a number of burner designs, the new idea of direct scrap melt-down with a high-velocity jet of oxygen, and a non-consumable device for introducing an oxygen stream for decarburization and scrap melt-down that may lead to mechanization for these parts of the process.

For the test program LINDE's DRIOX high-purity liquid oxygen was used because it was readily available at a price that made these tests economically practical. Anticipating the use of oxygen of lower purity,* LINDE has built, and operated for nearly a year a producing unit that has a capacity of about 200 tons per day of 90 per cent purity gaseous oxygen, the largest single unit ever built.

This makes the story of oxygen use in steel-making a promising one, although problems in furnace operation and in oxygen supply must be solved before economic advantages are assured.

Although the final chapters of this story are in the realm of conjecture, LINDE's extensive facilities for research and development will continue to be concentrated on this program so that the steel industry may benefit as knowledge is gained.

*Cost of low-purity gaseous oxygen will depend on purity, quantity, and pressure required; size of storage facilities; and other demand characteristics.

Management and production executives are invited to write for the factual report which LINDE *has prepared on oxygen use in steel-making furnaces. Please address Room 308, 30 E. 42nd St., New York 17, N. Y.*

Linde
Trade-Mark

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

The words "Linde" and "Driox" are trade-marks of The Linde Air Products Company.

You can get a HYDRO-BLAST

FOR CORE REMOVAL AND CASTINGS CLEANING

DESIGNED TO FIT YOUR INDIVIDUAL FOUNDRY PROBLEMS

★ ***REGARDLESS OF SIZE OR WEIGHT OF CASTINGS OR OF THE TONNAGE TO BE CLEANED PER DAY***

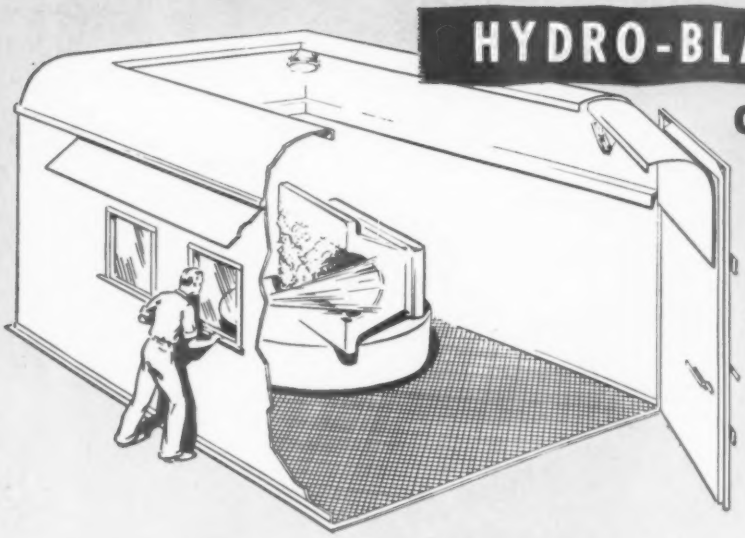
You'll find Hydro-Blast engineers good men to consult on modern cleaning methods—men whose long and intimate experience includes analyzing and solving cleaning problems in foundries of every type and size. That experience is yours to command—and with no obligation. Write us.

NO MATTER WHAT YOUR OWN CLEANING PROBLEM MAY BE, THERE'S AN EFFICIENT, ECONOMICAL HYDRO-BLAST APPLICATION TO ANSWER IT.

HYDRO-

2550 NORTH WESTERN AVE.

HYDRO-BLAST ROOM—
operator outside

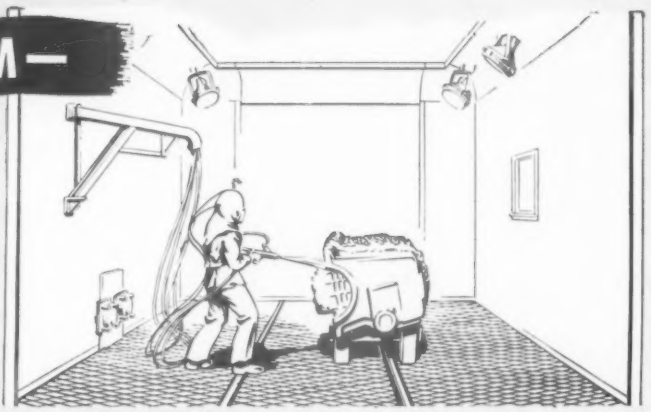


In many instances heavy, deeply cored castings can be economically Hydro-Blasted by means of large, mechanically mounted blast equipment controlled by an operator standing *outside the inclosure.* As a rule the castings are mounted on a turntable.

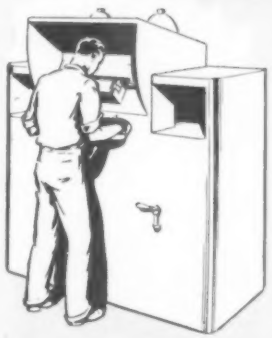
For cleaning castings too large for a turntable, the blasting equipment and operator can be mounted for moving mechanically back and forth across the face of the work.

HYDRO-BLAST ROOM—
operator inside

In foundries producing deeply cored castings, including many custom shops, cleaning can usually be most efficiently and economically done in a splash inclosure by Hydro-Blast operated manually. In many instances, it has been found convenient to handle castings on a turntable.

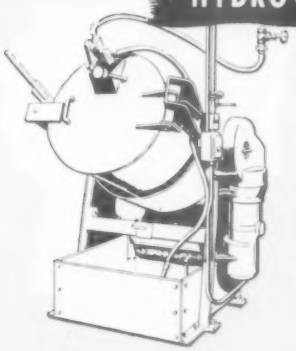


HYDRO-BLAST CABINET—
for cleaning smaller castings



Small castings requiring special individual attention, because of intricate cores or particular finish, can be efficiently and economically cleaned in a Hydro-Blast cabinet: handled by hand, as a rule, in small production; or, where volume production warrants, on a turntable or by conveyor equipped with special jigs, to convey castings through the cabinet.

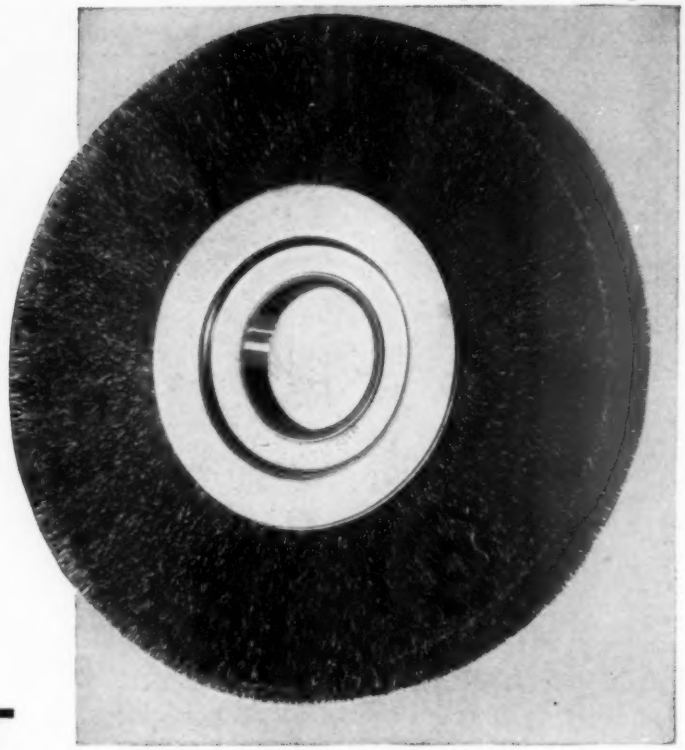
HYDRO-BLAST BARREL—
for small castings



Small castings suitable for tumbling can be effectively, economically cleaned and finished in the Whiting Hydro-Blast Wet Barrel.

-BLAST CORPORATION

CHICAGO 47, ILLINOIS



For Super Fast Cleaning and Finishing...

WITH EXTRA

L-O-N-G L-I-F-E

AND ECONOMY

Thor WIRE WHEEL BRUSHES

IMMEDIATE DELIVERY FROM DISTRIBUTORS STOCKS

Firmly anchored to the core by a patented, strength-adding process, the Double-Durable special crimp wire which fills Thor Wire Wheel Brushes has above-average resistance to crystallization and breakage. It holds its strength longer for continued efficiency in cleaning, de-burring, roughing and burnishing. Used on portable or stationary equipment with spindle speeds up to 6000 r.p.m., these Thor brushes do better work with maximum economy.

Made in sizes from 4" to 12" diameter, with wire from 30 to 36 gauge, Thor brushes are available in single-unit, arbor-hole adaptor or metal-center sectional types. A new Thor folder, No. 538, makes selection of the proper brushes for your jobs simple. Write for your FREE copy . . . today.

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... Thor PORTABLE POWER TOOLS

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CUTS GRINDING TIME 40%

THIS gray iron foundry cleaning room was using obsolete air grinders long after they should have been replaced. The Rotor Application Engineer checked their speeds and discovered they were 50% under par. He demonstrated and installed new Rotor Vertical Air Grinders—Type B-30 with 6" flared cup wheels. See lower left illustration. Now they get these results:

66% faster. The new tools have plenty of zip. Grinding time was cut 40%.

Pays for itself in 100 days because of Rotor grinder's increased production.

Easy to do good job because of tool's light weight and high power without pushing.

Perhaps we can do likewise for *you.*

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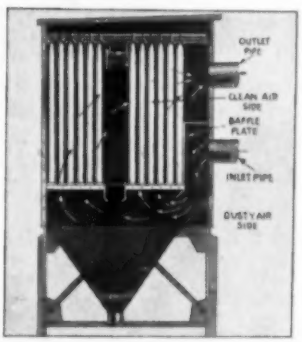
What is the *Measure* of *Effective* Dust Control?

To determine the effectiveness of a dust collection system these three factors must be considered . . . efficiency . . . economy . . . dependability.

On-the-job performance proves that the American Dustube meets the most exacting requirements. It traps all dry dusts, regardless of particle size or concentration, with nearly 100% efficiency by weight. Discharged air shows less than 10 million particles per cu. ft. from 2 to 10 microns in size, as determined by the impinger method. Dustubes excel on the cost side of the picture, too. There are only a few working parts to wear. Power costs are exceptionally low because the resistance to air flow (back-pressure) is much lower in a Dustube than in any other cloth type collector of equal capacity.

The Dustube has many other advantages which add up to lower cost of operation; for example, the tubes are light, compact, inexpensive to ship and store; it takes only one man a few seconds to install a tube and he requires no tools; as the tubes are never under tension and never abraded by contact with metal, tube replacement is seldom required; tubes are quickly and thoroughly freed from dust by an improved shaking method . . . dust precipitates directly into the hopper, never upon other dust cells which lie in its path.

There is nothing complicated about a Dustube . . . it is the simplest cloth type collector on the market. You will find it unmatched for efficiency and economy. Thousands are in daily operation. Write for Bulletin 112.



Cross section view of a Dustube showing simplicity of design. Ample spacing of tubes decreases resistance to air flow thereby saving costly power.

One man can install a Dustube filter tube in a few seconds using no tools.

Actual performance results prove that Dustubes meet the most exacting requirements.

Shaking the filter tubes while deflated cleans the cloth quickly and thoroughly.

American
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dustube
DUST COLLECTORS

Safety Can Make the Job More Attractive

MUCH attention has been given the last few years to the improvement of working conditions as a means of making foundry employment more attractive. This movement often has been reflected in efforts to control dust and smoke and to minimize the amount of manual effort required in various operations. Indirectly, of course, this trend also promotes safer working conditions, but it would seem that attainment of the ultimate in safety should be a predominate aim in what efforts are made to enhance the desirability of foundry employment. Surely the worker's life and limb are major considerations from his viewpoint in the selection of a job. . . .

While the foundry industry's safety record has improved materially during the last 20 years, it has not shown the results that would have obtained if the problem had been attacked intensively and universally, as has been done in some other industries. Of the various industries on which the National Safety Council compiles accident records, foundries rank among the one-fourth which show the highest accident frequency rate. These data are based on reports from foundries representing in number less than 5 per cent of the industry; but regardless of whether or not this sample may be considered too low to truly reflect industry-wide experience, relatively few foundries can claim to have done everything humanly possible to reduce accidents to a minimum.

In a number of instances foundries cannot afford or are not suited to the use of certain equipment which will eliminate manual effort from various operations. However, it has been proved that safe working conditions are not solely the result of mechanical devices. Rather safety depends primarily on the attitude of the entire plant organization—on how well everyone, from executives to common laborers, is convinced of the importance of safety and acquainted with the safe way of handling each job. Obviously, this requires a carefully planned program, one that not only must have the strong support of management, but must also lay its foundation on good housekeeping and encompass maintenance as well as operating departments. It also requires endless vigilance to assure that once an effective program is established it is carried out.

Many foundries—both large and small—can boast of safety records markedly better than the reported averages for either the industry or for manufacturing in general, thereby eliminating automatically all debate as to whether or not it is possible to minimize the hazards connected with foundry work. These good safety records must be made the rule rather than the exception if the attempts to make the foundry industry a desirable place for employment are to be fully effective. The slogan, "The foundry is a good place to work," is meaningless unless "good" also implies "safe."

William G. Gude

Managing Editor

New Coreroom

IS MODEL OF EFFICIENCY

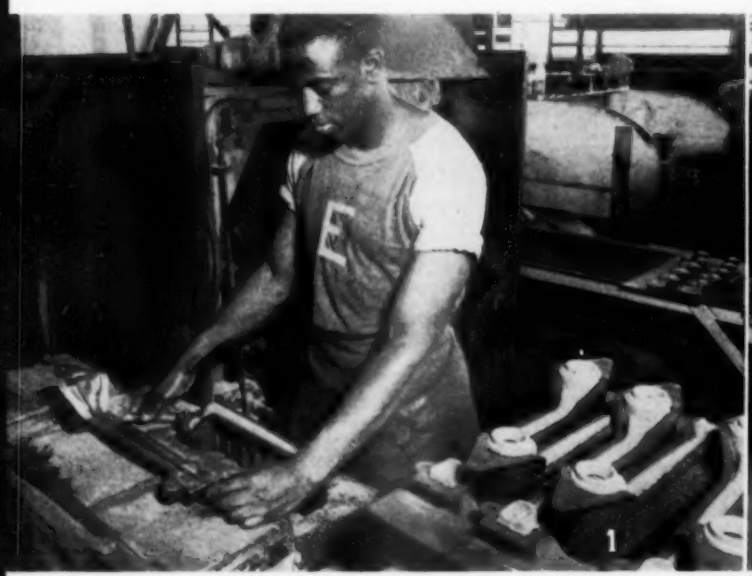
THE PERFECTLY appointed and ultramodern core-making department recently erected and equipped at the plant of the Cleveland Foundry Co., Cleveland, marks the culmination of 80 years of continued growth and expansion of a business originally organized and operated for many years under the title Cleveland Co-operative Stove Co. The company was organized in 1867, two years after the conclusion of a four-year war that left the country economically, financially and spiritually flat on its back. Growth was comparatively slow in the early years, but the company steadily forged ahead in prosperous periods, and also survived the lean periods which swept the country periodically in the '70s, and '80s and '90s of the past century, and the equally uncomfortable, even if known by the euphonic depression periods, which marked 1903-07-13-21 and the melancholy 1930's of the present century.

By 1919 the business had expanded to a point where the old foundry at East 67th street and Central avenue was crowded to and beyond capacity. A new, and at that time highly modern, brick, steel and glass foundry, 135 x 500 ft, was erected on Harvard avenue and equipped with every facility for straight-line mass production of stove and range castings. Iron was melted in an 84-in. diameter cupola lined to 60 in. located in the center of the foundry. Later the foundry was extended 500 ft and two additional cupolas of equal capacity were installed and spaced midway between the center and the ends of the building. The coreroom was located in a section at one end where it remained until recently.

A description of the new foundry published in THE FOUNDRY, August, 1917, stated that the coreroom occupied an area 50 x 135 ft at the south end of the foundry. The coreroom was divided into two sections by the 15-ft gangway which extended through the floor from end to end of the building. One core oven, 8 x 10 x 18 ft, of the drawer type served the requirements of the entire foundry. Cores were made by hand on the benches. After they were baked, they were placed on movable racks and trucked to the molding floors. The oven was fired with coke through a pit at one end. Additional ovens were installed when the foundry was extended.

Shortage of materials, equipment, skilled help and many other factors complicated the problem confronting the company when the War Production Board set the STOP signal July 31, 1942, against the manufacture of stoves and ranges for domestic and other civilian use. The company, with one of the finest stove shops in the country, with a large force of highly skilled employees and with a history and record of achievement and perseverance over and up and down period of 75 years, calmly accepted the ultimatum as just another hurdle to be surmounted.

Miscellaneous light and medium weight castings, including machine tool castings up to 1000 lb were made until restrictions were lifted at the close of the war and manufacture of stove and range castings was resumed. To fill the molds made by 175 molders, three cupolas melt



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By PAT DWYER
Engineering Editor
THE FOUNDRY

Fig. 1—Core is blown by machine and vented with a wire

Fig. 2 — Gang core is rammed by hand and vented by plate with raised vent members

Fig. 3—General layout of coreroom with right and left twin units

Fig. 4—A long belt carries the cores from the benches and machines to the tower ovens

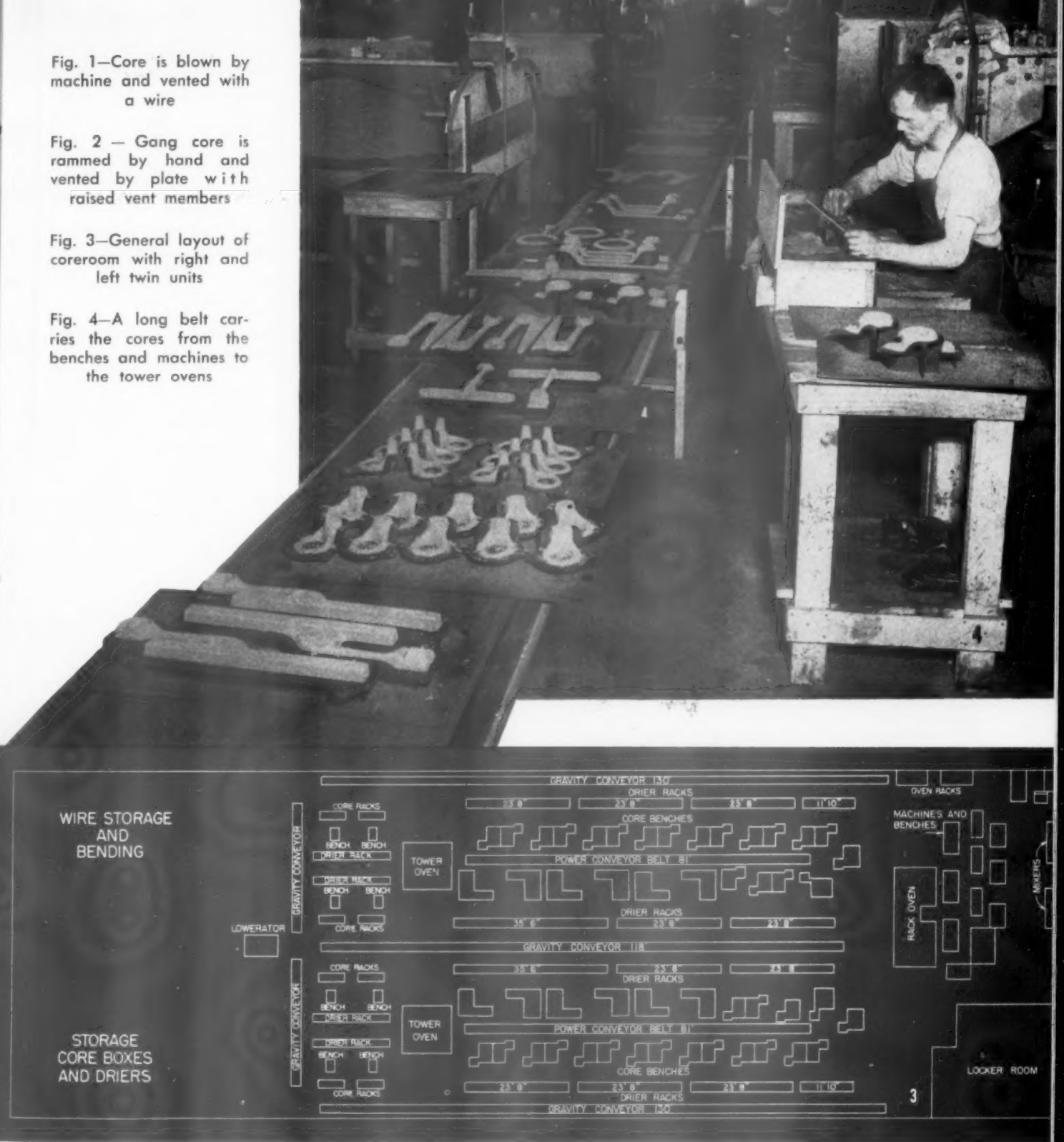

Fig. 5—Shelves in the tower ovens are of open construction

Fig. 6—Dried cores are stacked on the sorting tables

Fig. 7—An elevator takes cores to the lower floor and brings boards back

Fig. 8—On long tables on the lower floor cores are closely inspected and segregated

Fig. 9—For transfer to the foundry cores are loaded on carriers suspended from a monorail

New Coreroom

IS MODEL OF EFFICIENCY

120 tons per day. The yield in the type of foundry where the gates and sprue may equal and in some instances exceed the weight of the castings, is approximately 54 per cent. Under present conditions with castings playing a minor, but still essential role in the construction of stoves and ranges, the Cleveland Foundry Co. absorbs only a small amount of castings. Approximately 95 per cent of the product is shipped to stove builders in various parts of the country.

During the recent reconversion period when the company returned to the original business of producing stove, range and miscellaneous light gray iron castings, the volume of business necessitated further enlargement of the plant. The space formerly occupied by the coreroom was arranged and equipped in a similar manner to the existing molding department. A two-story brick, steel and glass building, 80 x 230 ft, was erected close to and parallel to the main building expressly for the production of the immense quantity of small cores required in daily operation. A concrete idea of the number and variety of these small cores may be had from the statement that approximately 20 tons of sand is consumed in their production every day. Typical groups of cores are shown in some of the accompanying illustrations.

General layout of the second floor is shown in Fig. 3. General flow of production is from right to left, from the sand reservoirs and mixers at one end, through the ovens and to the mechanical elevator which delivers the cores to the lower floor. Here the movement is reversed. The cores pass over the inspection and finishing benches through the storage racks and then, as required, are loaded on double deck platforms suspended from a monorail which conveys them into the foundry where they are distributed to the various molding floors.

Two varieties of sand in various proportions are used for making the cores. One is a fine grain bank sand and the other is a fine grain silica sand from the Ottawa district. Truck loads of sand are dumped outside one end of the building. The sand falls into a hopper below the ground level and from there is lifted by a bucket elevator which may be arranged to discharge right or left into two concrete block silos, 14 ft diameter and 45 ft high with a capacity of 300 tons. To resist the sand pressure, the silo walls are reinforced with 3/4-in. diameter steel bands spaced about 12 in. apart from top to bottom.

The upper part of the silo is separated from the lower part by a diaphragm set at a 45 degree angle, with the high point at the back and the low point at the side next the building. A chute from the low point conducts the sand as required through an opening in the wall and discharges it in measured amounts into the tote boxes which feed the mixers in the vicinity. The dried sand flows by gravity. Near the bottom of the silos in the sides facing the elevator, a slide allows the sand in the lower part of the silo to flow into the central or original hopper. From this point the bucket elevator carries it aloft and discharges into the part of the silo above the diaphragm. With the exception of the work done by the bucket elevator all other movement of the sand is conducted by the simple and natural force of gravity. The sand is perfectly smooth and dry and runs through the various passages as readily as a liquid.

Inside the building the sand is mixed in two revolving paddle type sand mixers. Each 500-lb batch is bonded with core oil in the proportion of 1 part oil to 40 parts sand. Approximately 1 per cent cereal binder is added to the batches designed for cores that need a little extra green strength. Water content of the mixture is held to between 5 and 6 per cent. Sand in these cores is not rammed in the usual manner. Some of the larger cores are made on jolt machines. Others are made on a battery of core blowing machines where the sand is driven into the coreboxes under air pressure of approximately 100

New Coreroom

IS MODEL OF EFFICIENCY

psi, but the majority of the cores are made in small coreboxes where the sand simply is pressed into place by the fingers of the operators.

Majority of the cores are intricate in character where the most essential feature is high permeability, and this is facilitated to a certain extent by easy ramming. All cores are made as complete units. No cores are made and dried in halves and then pasted. Typical methods of venting cores are shown in Figs. 1 and 2. In Fig. 1 where the core is made in a two-part box and blown under a core blowing machine, a long steel vent wire is laid in the lower part of the box, one end resting on a small post, the other end projecting through the opposite end of the box. After the corebox is blown full of sand and before the upper half is lifted, the wire is withdrawn, thus leaving a vent hole through the center of the core.

Fig. 2 shows a two-part corebox in which half a dozen small crooked cores are made at a time. Obviously a vent wire could not be removed from these cores. The two core plates are connected by hinges. The cavities in each half are filled with sand pressed in by the fingers. The joint of each is scraped off flush. A third plate mounted upright back of the corebox has small ridges on the face, one ridge for each core. This plate is swung down and pressed against the face of the corebox where the ridges leave vent passages in the joint face of the cores. The two half coreboxes are brought face to face in a vertical position—*booked* is the foundry term—then lowered back to a horizontal position. The upper half is lifted and swung back to the original position on the left unit of the machine, leaving the complete cores in the middle section. A light, open frame drier shell is lowered over the cores and the assembly is rolled over to leave the cores in the drier as shown to the right.

Drier shells are made according to two designs, depending on shape, size and general contour of the cores. In one design, the drier shell serves as the lower half of the corebox. After the corebox is filled with sand, the upper half is removed and the lower half supporting the entire core is sent on the way to the oven. In a second method the two half coreboxes remain in constant use. The drier shells are separate and independent. After the box has been packed full of sand, either by ramming or blowing, the upper half is removed and replaced by the drier shell. The assembly is rolled over and the second half of the box is removed, leaving the core resting in the shell for passage through the oven. In either instance a sufficient number of shells must be provided to serve each operator in the period between the time the first one leaves his hands, until it is returned from the cycle approximately 2 hours later. Driers are sand blasted periodically to keep the surface clean and prevent the cores from sticking.

Main features of the second floor of the new coremaking department, as shown in Fig. 3, include the gravity and power conveyors, the two tower type core ovens, operator's benches and blowing machines, drier racks, lowerator for transferring dried cores to the lower floor, wire cutting and bending department, locker room, and power operated machines and rack type oven near the right end for making and drying larger cores. The two paddle type sand mixers, as previously mentioned, also are located close to the wall at this end in close proximity to the chutes which deliver sand from the silos on the outside of the building. Prepared sand is delivered to the various blowing machines and benches in tote boxes.

The general layout shows that the coreroom is a duplicate or twin installation, or two similar but independent units working side by side. They are separated by a low gravity type conveyor 118 ft in length. Since both units are exactly identical, a more or less detailed description of one will serve for both.

The batteries of machines and benches occupy space on both sides of a power operated belt conveyor 81 ft in length. Operators on both sides place the green cores on this belt which conveys the cores to a high tower type,

Fig. 10—Wires are cut and bent for the various cores. Dryer shells in racks at back

Fig. 11—Storage racks filled with segregated and inspected cores

Fig. 12—Typical display boards showing part of the wide variety of castings made

gas-fired oven equipped with swinging skeleton or open work shelves for free application of the heated air. Attendants on one side lift the green cores from conveyor to oven shelf. The cores travel upward through a moderate zone, then through a zone of maximum temperature, approximately 400° F, and then descend on the other side of the oven, through a moderate and then a cooling zone before they arrive at the discharge level, where they are removed and placed temporarily in storage racks.

According to definite schedule, the cores are removed from the racks, loaded on small boards and placed on a transverse gravity conveyor which delivers them to a lowerator where the swinging shelves work on the same principle as the shelves in the oven. Under electric push button control the device may be operated steadily or intermittently. An attendant on the lower floor removes boards and cores. The cores go to the inspection and finishing benches. Empty boards are loaded on the swinging shelves of the lowerator and removed when they arrive at the second floor level to complete the cycle.

When the cores are removed from the oven they are still resting in the drier shells. In the majority of instances they may be removed readily. Where the core shows a slight tendency to stick, the operator raps the drier lightly to break the connection. The attendant loads the cores on 2 x 2-ft boards and (*Please turn to page* 130)

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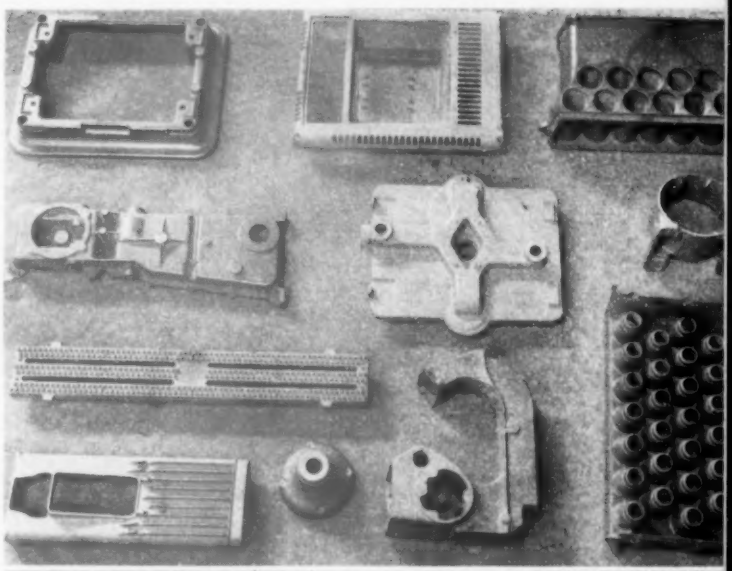

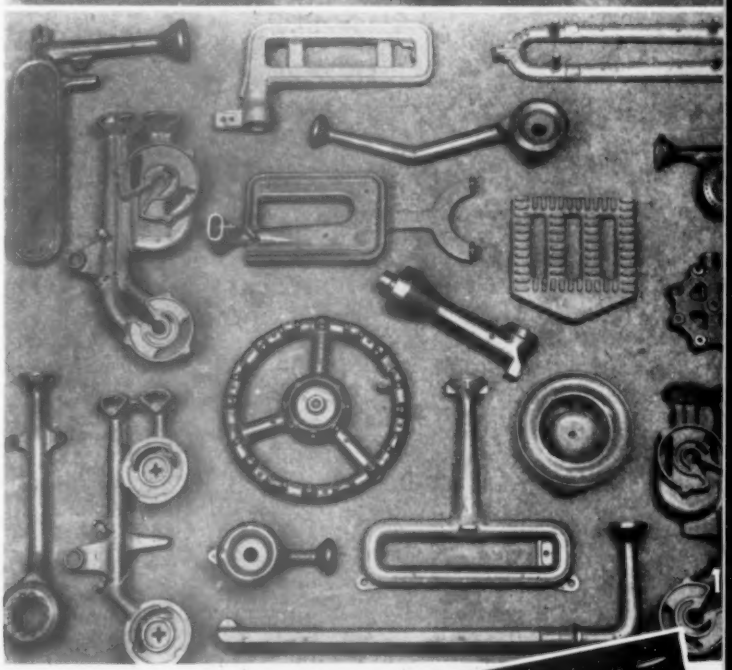

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EFFECT of CHILLS on rate of Solidification of Gun Metal

IT IS unnecessary for nonferrous foundrymen to rely solely on sand to dissipate the heat evolved by metals during solidification. Other materials now available may be used in place of sand or in conjunction with it, either to increase or decrease the rate of dissipation of heat, then by providing wide range of freezing rates. Although a large number of materials are used in controlling the rate of freezing, little information is available on the relative effects of even some of the most common ones, such as sand, steel, carbon and graphite. The results of an investigation on the effect of these commonly used mold materials on the rate of solidification of gun metal (copper 88 per cent, tin 8 per cent, and zinc 4 per cent), are given in this paper.

Materials, usually in the form of inserts molded into the sand, which increase the rate of solidification over that normally occurring in sand molds, are termed chills. The efficient use of chills depends not only on their thermal conductivity, specific heat, density and emissibility, but also on their characteristics in service such as their indestructibility, dimensional stability and ease of removal from the casting. Although it is desirable that the chill be in direct contact with the metal in both the liquid and solid states, the contact must not be so perfect that welding or fusion takes place. In practice, chills often separate from the metal shortly after solidification has occurred and an air-gap is created between casting and chill. The seriousness of this broken contact depends largely upon the temperature at which it takes place, the width of gap, and the emissivities of the surfaces. For practical purposes the separation of chills from castings at low temperatures is an aid rather than a hindrance in foundry operation.

Careful consideration should be given to the selection of materials to be used for chills and certain precautions in their use should be observed. Some of the more obvious dangers to be avoided are rust, scale and moisture on the surface. Usually storage in a dry room, cleaning, and sandblasting before use are necessary to prevent defects near the junction of the chill and casting. To prevent condensation on the chill after it has been placed in the mold, the mold should not be permitted to stand overnight. Special precautions should be taken to provide for directional solidification. Otherwise, chills may intensify rather than prevent shrinkage porosity.

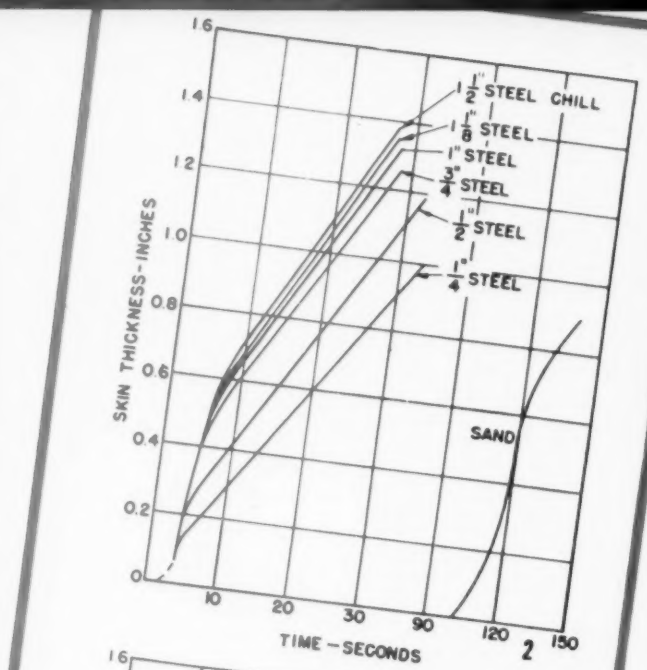
In the present investigation, approximately three hundred measurements of thickness of solidified sections of gun metal were made. In the first part of the investigation the relative chilling action of sand, graphite, carbon, and steel was determined by using the various chill materials as inserts molded into the sand. These materials formed one 6 x 6 in. face of the mold cavity which was in the shape of a rectangular block 2 x 6 x 6 in. Thickness of the inserts was varied in suitable increments from 1/4-in. to 1-1/2. The skin formation on the inserts was found by bleeding the castings at progressively increasing periods of time and measuring the thickness of the solidified layer of bronze adjacent to the chill. The pouring temperatures were 1150°C ± 50°C and 1100°C ± 50°C.

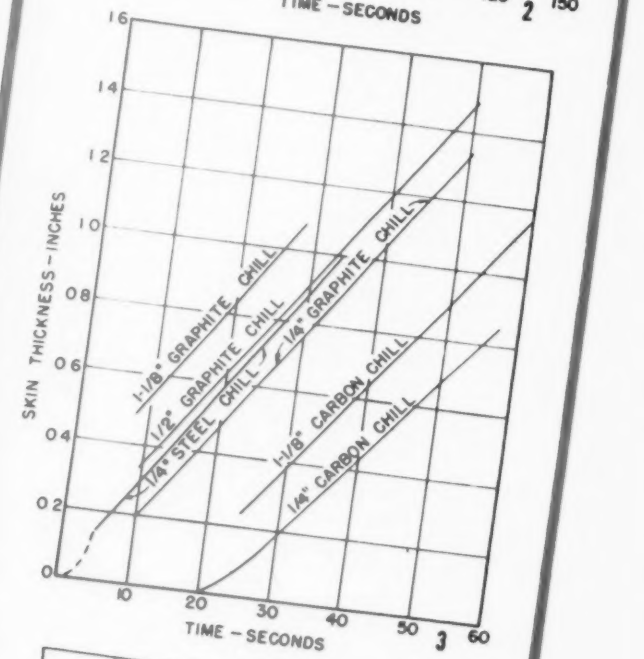
Change Thickness of Chill

In the second part of this investigation the width of the casting was changed as well as the thickness of the chill, in order to determine the most efficient thickness of steel chill for a given section of gun metal casting. The width of the casting was 1/2, 1 and 1-1/2 in. and the thickness of the steel chills was varied as previously mentioned. This part of the investigation was confined exclusively to the action of steel chills. A special term was invented to describe the new measurements. This was the "time to end of bleeding," which is the time at which not more than a few droplets of molten metal would fall from the inverted casting. The "time to end of bleeding" denotes that condition in the casting when the interlocking dendrites growing inward from the walls (one chill and one sand) meet at the center portion sufficiently to prevent the free flow of molten metal over appreciable distances. The "time to end of bleeding" was measured with the various thicknesses of steel chill and various section sizes at pouring temperatures of 1150°C ± 50°C and 1100 ± 50°C.

Melting and Casting—The metal used in this investigation consisted of primary copper, zinc and tin, or scrap of known composition from previous heats. The charges were melted in clay-graphite crucibles placed in a lift coil induction furnace. The virgin copper or scrap was melted under charcoal and deoxidized with 2 ounces of phosphor copper (15 per cent phosphorus) per hundred pounds of metal. The tin and zinc were added subsequently and the melt poured at the required temperature. The molds were made of synthetic sand of the following composition: Sand (washed silica, AFA No. 61) 96.0 per cent, bentonite 2.5 per cent, dextrine 1.2 per cent, cereal binder 0.3 per cent, water added to give moisture content of 3.0 to 3.5 per cent.

The clay-graphite crucible was removed from the furnace and the metal was poured directly from the crucible into the molds. Lip of the (*Please turn to page* 252)





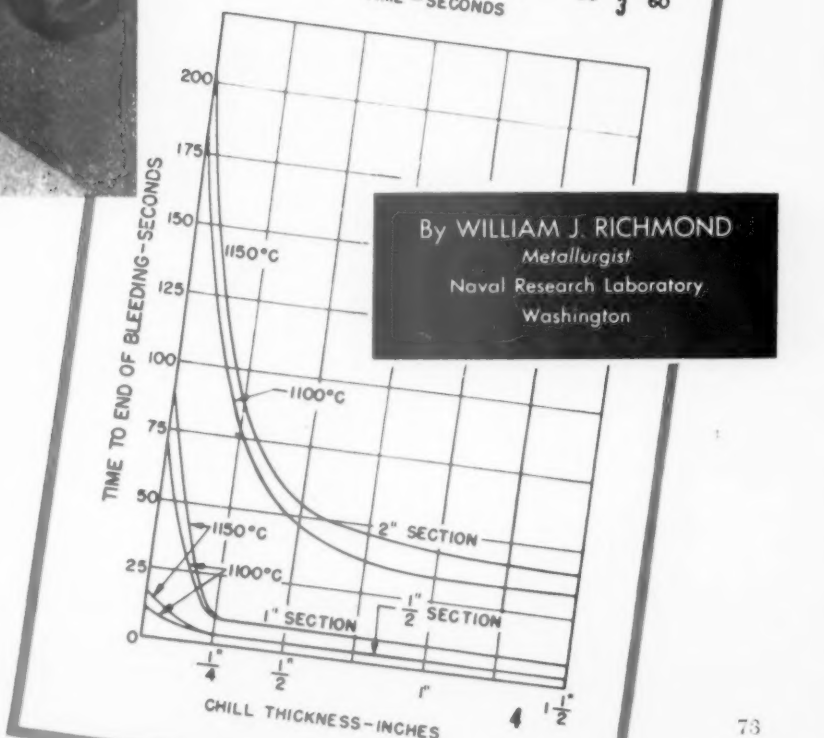


Fig. 1—Bleeding of mold. The flask is mounted in trunnions to facilitate inverting the mold

Fig. 2—Skin formation on steel chill and sand of 2 x 6 x 6 in. mold. Pouring temperature 1150°C

Fig. 3—Skin formation on chills of 2 x 6 x 6 in. mold. Pouring temperature 1150°C

Fig. 4—Chart plotting thickness of steel chill against time to end of bleeding

By WILLIAM J. RICHMOND
Metallurgist
Naval Research Laboratory
Washington

Use of

IN OPEN-HEARTH A

ALTHOUGH experiments with the use of oxygen to increase steel production date back more than 20 years, it is only within the last few years that the subject has received intensive study. These recent investigations have resulted in a steadily increasing number of steelworks which are employing oxygen as a means of shortening the period of time between charging and tapping certain of their furnaces.

It should be pointed out that while considerable data and experience have been accumulated in this use of manufactured oxygen, the subject still is in the development stage and operating practice is not yet standardized. Actually, the effect of oxygen use on total steel production has been neglibible so far, because the process has been applied to only relatively few furnaces. Widespread adoption must wait until the capacity for producing commercial oxygen is far greater than it is today.

To date the largest oxygen use in steelmaking furnaces has been with the open-hearth unit, and these have been principally furnaces operated by primary steel producers. At the same time, a number of steel foundries also have been using oxygen injection in melting practice both with open-hearth and electric furnaces. Good results have been obtained in electric furnace operations, but since the open-hearth furnace is the principal melting medium of steelworks, more experience has been obtained on oxygen use with that type of unit than with the electric furnace.

The question naturally arises as to whether oxygen also cannot be applied successfully to other types of melting units, such as the cupola furnace, blast furnace, and bessemer converter. In the case of the blast furnace and converter the use of oxygen has not yet been proved practical in the U. S. based on the limited experience acquired to date. Nor can any conclusions be reached as to the possible role of oxygen addition to the cupola blast, because so far very little experimental work has been conducted. However, some studies are in prospect.

Since the use of oxygen in the open-hearth or electric furnace results in a speeding up of the melting and refining operation, it is obvious that unless a plant is able to make prompt disposition of the increased supply of molten metal, an important advantage of the process is lost. For instance, if the molding and pouring facilities of a steel foundry are currently in balance with its furnace capacity, the benefit of a reduced charge-to-tap time might be limited largely to what saving could be effected in fuel cost. On the other hand, a decided advantage would result in those instances where increased production of castings is being prevented because of an inadequate supply of hot metal. Where a large number of furnaces are employed, as in a steelworks, oxygen use may provide the same output from fewer units and permit shutting down the least efficient furnaces.

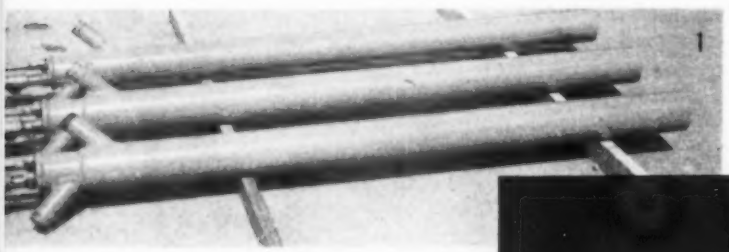


Fig. 1—Side view of open-hearth main burners showing fuel, oxygen and cooling water connections. These burners were designed for hourly flow rates of 200 to 500 gal of fuel, 15,000 to 60,000 cu ft of oxygen at 100 psi, and 1000 gal of cooling water. Fuel atomization with auxiliary steam atomizer averages ¼ to ½-lb steam per pound of fuel

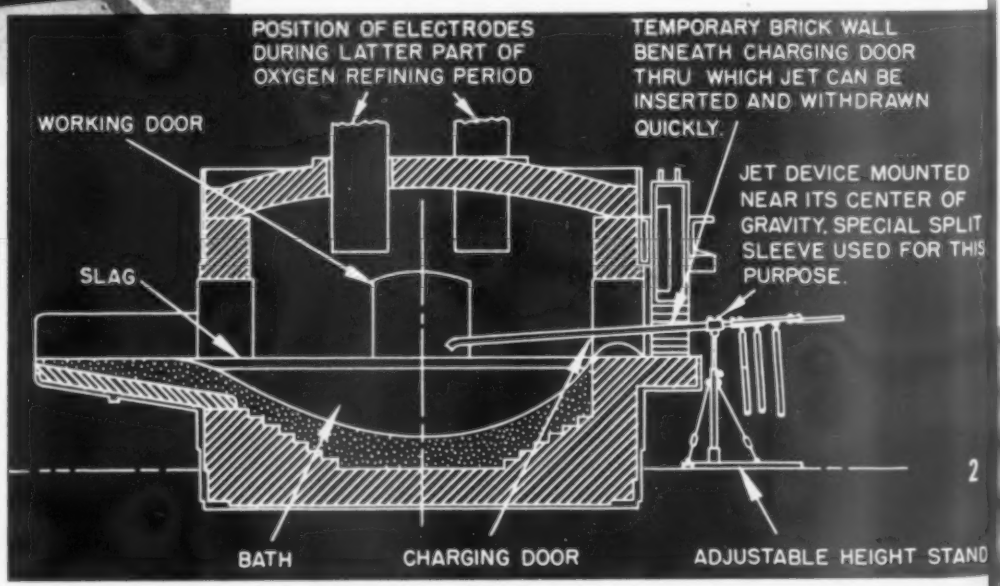

POSITION OF ELECTRODES DURING LATTER PART OF OXYGEN REFINING PERIOD
TEMPORARY BRICK WALL BENEATH CHARGING DOOR THRU WHICH JET CAN BE INSERTED AND WITHDRAWN QUICKLY.
WORKING DOOR
JET DEVICE MOUNTED NEAR ITS CENTER OF GRAVITY. SPECIAL SPLIT SLEEVE USED FOR THIS PURPOSE.
SLAG
2
BATH
CHARGING DOOR
ADJUSTABLE HEIGHT STAND

Fig. 2—Cross section of tilting electric furnace showing method of installing jet device for oxygen introduction

This article is based on information and operating data furnished by the Linde Air Products Co., unit of Union Carbide & Carbon Corp., New York. Photos are by courtesy of that company

# of Oxygen

TH AND ELECTRIC FURNACESS

By WILLIAM G. GUDE
Managing Editor
THE FOUNDRY

Practically all of the experimental work with oxygen in open-hearth and electric furnaces has been with oxygen of 99.5 per cent purity, the standard commercial product, because oxygen of this purity is so much more readily available and convenient to use than oxygen of lower purity or even than compressed air. In fact, compressed air or low-purity oxygen in the quantities and at the pressure needed are not at the moment readily procurable at most open-hearth furnaces. Many of the conclusions so far drawn as to the effect of pure oxygen, especially the economics, may be altered when the results on the performance of oxygen of lower purity and of compressed air have been ascertained.

Oxygen is used in open-hearth and electric furnaces in two distinctly different ways. It is employed first to melt down the charge and second to refine the bath. In both cases the oxygen addition increases the temperature within the furnace, thereby accelerating each operation, and in the decarburization process bubbling the oxygen into the molten bath also speeds up the reaction whereby carbon is removed from the liquid metal.

Open Hearth Practice—Shortening the meltdown period has been accomplished by four different methods: 1. Enrichment of air by passing oxygen through the end burners or through auxiliary equipment located immediately adjacent to the end burners. 2. Scrap melting by directing oxygen onto preheated scrap. 3. Use of oxygen in auxiliary burners to supply a fuel-oxygen flame to accelerate melt-down. 4. Enrichment of air by injecting oxygen into the intake to the checkers. These four methods shorten the melt-down period in either of two ways: a. By raising the rate of burning fuel, permitting higher firing rates; by increasing flame temperature in contact with scrap; and by increasing and directing radiation. b. By actually burning iron in the scrap, thereby providing heat from combustion, and by permitting more effective utilization of end burner flames through rapidly increased combustion volume and through increased scrap area exposed to the action of the flame.

In order to have some device for evaluating the results obtained from use of oxygen at any one furnace, as compared with another furnace, a figure called the *merit factor* was evolved. It is defined as 100 times the percentage reduction in charge-to-tap time divided by oxygen consumption (in cubic feet) per ton of ingots.

Selection of the most suitable method of using oxygen is dependent chiefly on the percentage of cold charge, facilities for charging, type of steel produced, and furnace conditions. Scrap melt-down by directing oxygen onto preheated scrap and oxygen enrichment through burners can be advantageous when scrap percentages are relatively high, and efficient charging is practiced. In general, the scrap charge must be 35 per cent or more before use of oxygen is indicated, although this might be somewhat lower in shops using relatively old, inefficient furnaces.

Introducing oxygen through main burners is the method utilized for the largest number of experiments conducted with open-hearth furnaces. The function of the main burners is the supplying of heat to melt the scrap, cause the furnace refractories to attain and hold the desired temperature during the various stages of the heat, and maintain bath temperatures during refining. For these purposes about 3.5 to 4.5 million Btu of heat are required per ton of steel. In shops using a 100 per cent cold charge, the heat input rises to as much as 5.5 million Btu per ton, or more.

While a considerable variety of end burners have been used to introduce oxygen into open hearth furnaces, the majority of burners fall into two types:

1. Burners containing an annular passage to supply

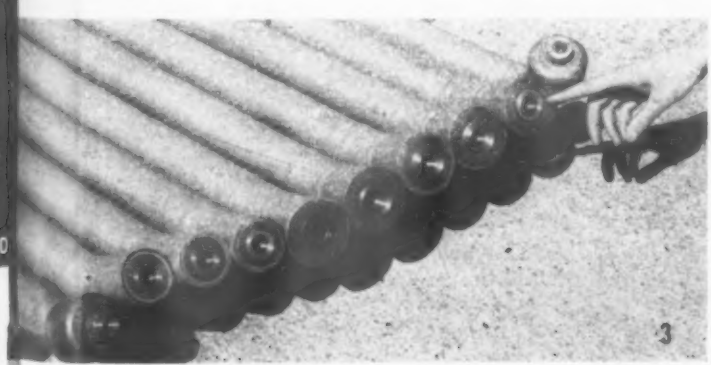


Fig. 3—Exchangeable copper nozzles shown in place on jet devices. Most of these same nozzles will fit the end burners shown in Fig. 1

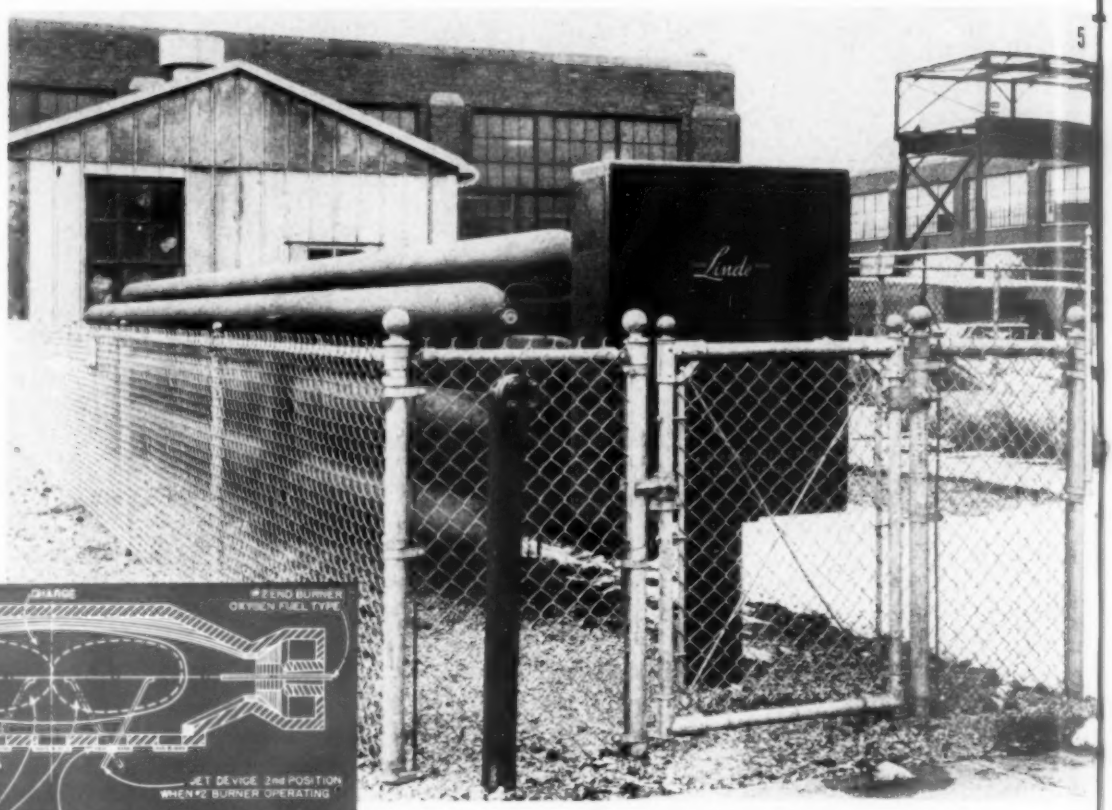


Fig. 5—Type of oxygen storage facilities adapted to monthly consumption of 50,000 to 750,000 cu ft

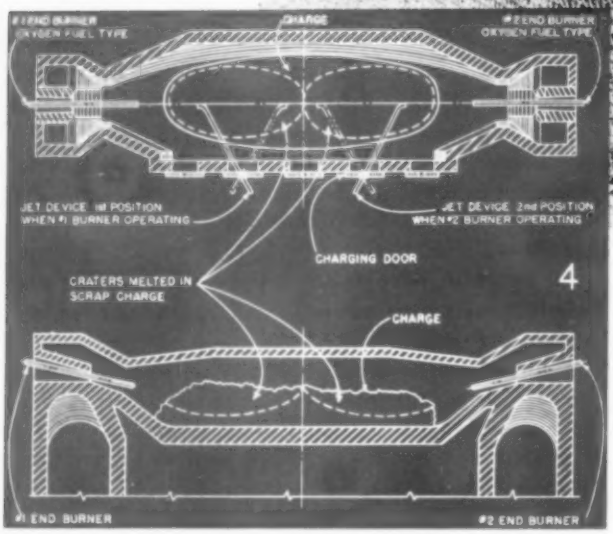


Fig. 4 — Sections of open hearth showing zones of charge affected by jet device when used for pure oxygen meltdown

relatively low velocity oxygen in a sheath around the fuel.

2. Burners containing a single passage to supply a high velocity oxygen stream below the fuel.

Burners, when operating with oxygen, must produce a flame of sufficient length and with characteristics suitable for transmission of maximum heat to the charge without overheating furnace refractories. This same burner must also produce a satisfactory flame when operating in a normal manner without oxygen.

Oxygen enrichment can be provided for existing burners by furnishing a water-cooled, auxiliary installation containing a high pressure oxygen nozzle to supply a high velocity oxygen stream below the fuel stream. The head of the auxiliary equipment has a replaceable nozzle designed to furnish supersonic oxygen velocities.

The increase in flame temperatures caused by oxygen enrichment is not known with accuracy. Actual measurement of flame temperature in an open hearth is difficult because of the nature of the flame. However, theoretical considerations indicate that an increase in average flame temperature in the neighborhood of 200 to 400 F should be attained readily with oxygen enrichment. At localized points where the oxygen concentration is higher, the increase in temperature would be higher. For example, the maximum temperature of a hydrocarbon-air flame is about 3500 F, while maximum temperature of the hydrocarbon-oxygen flame is about 5000 F.

Careful analysis of 728 open-hearth heat records shows that a 10 to 25 per cent reduction in charge-to-tap time can generally be effected in open hearths where conditions indicate the use of oxygen in end burners. The oxygen consumption required for this purpose varies from somewhat less than 400 to about 750 cu ft of oxygen per ton of steel per heat. Corresponding merit factors range from 2 to 6.

Scrap must be supplied to the furnace at a rate at all times equal to the melting rate if oxygen is to be used to full advantage, but few shops that are melting with oxygen have provided adequately for this factor. Several heats made under conditions where the furnace on oxygen was favored with respect to scrap illustrate what may be ultimately accomplished. As an example, production from a 125-ton open hearth was increased 32 per cent with 337 cu ft of oxygen per ton. A merit factor of 7.2 was obtained.

Rapid melting obtained with oxygen supplied to end burners produces less oxidation of the scrap than does normal practice. Reduction of absorption of sulphur from the fuel also is to be expected because of the shorter time of exposure of the scrap to the flames.

Enrichment of air with oxygen supplied through end burners has not caused a noticeable change in refractory life on furnace side walls, back walls, or roof, when care is taken to direct the flame properly and to confine as much radiation to the bath as possible.

Additional benefits have been obtained by using oxygen through main burners. For example, the performance of one furnace at the end of its campaign was recently "sharpened" sufficiently by use of oxygen to permit con-

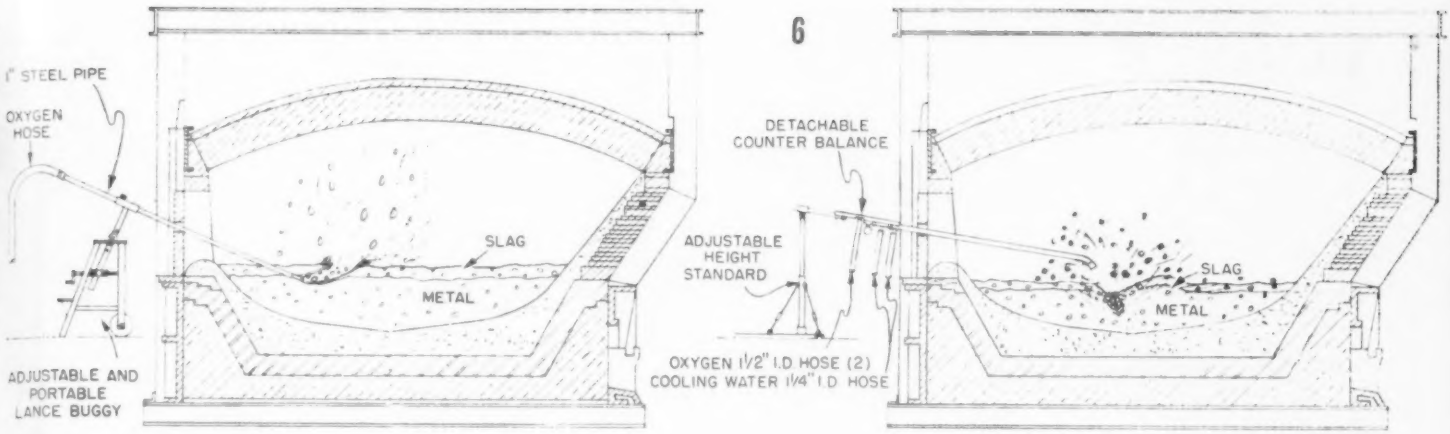


Fig. 6—*Left:* Lance mounted on buggy directing oxygen on open-hearth furnace bath. *Right:* Jet device which causes oxygen to penetrate slag and into metal

tinued operation for thirty additional heats. During a portion of its extended life this furnace led the shop in production.

Foaming, rising slags have been combatted effectively in several plants by continuing oxygen flow through end burners to increase the slag temperature and thereby reduce viscosity. In addition, oxygen burner practice yields a better control of slag temperature in shops utilizing flush slags, thus increasing the ease of handling and removing the slag.

Steel produced in open hearths supplied with oxygen-enriched flames is reported to be normal in metallurgical quality with respect to rimming behavior in molds, cleanliness, physical properties, and aging tendencies to the extent that it has been possible to measure such qualities to date.

Oxygen directed at preheated scrap is a new approach to the problem of reducing the melt-down time in the open hearth, although as yet it has been tried on only a relatively small number of heats. In this method a high velocity oxygen stream is directed through a jet device at preheated scrap. The jet device consists of a central oxygen supply pipe surrounded by two concentric water-cooled passages. The head of the device is equipped with replaceable nozzles. The effect of the oxygen jet is to:

1. Cut down rapidly exposed portions of the scrap, producing a small amount of superheated molten scrap steel.

2. Clear a path for the main burner flame and increase the area of charge exposed to the flame, thereby improving over-all heat transfer from the main flame.

In order to start melting scrap with the oxygen jet, sufficient preheating to bring a considerable portion of the scrap charge to the ignition temperature, approximately 2500 F, is performed with the regular end burner operating with or without oxygen. This may require from 20 minutes to slightly less than an hour. Oxygen is then directed at the preheated scrap through the jet device inserted in the wicket hole of a charging door near the operating end burner, and is supplied at high velocity (oxygen pressure 75 to 100 psi) and flow rates ranging from 15,000 to 60,000 cu ft per hour. Rapid oxidation and melting require frequent adjustment of oxygen jet position for most effective performance. By this method, utilizing the self-sustaining combustion of the scrap to furnish heat, large craters about 7 ft in diameter and 3 ft deep can be melted readily in a relatively short time.

Most of the work of directing an oxygen stream onto the preheated scrap has been done with the jet device, although stainless steel or coated steel pipes may be satisfactory.

Much higher oxygen utilization efficiencies have been achieved in the few large scale, oxygen-jet melting studies completed to date than were secured with similar quantities of oxygen in end burners. Operating on a charge comprising 60 per cent cold scrap, a 25 per cent reduction in charge-to-tap time resulted from injection of about 40 cu ft of oxygen per ton of preheated scrap in a 180-ton open hearth through a jet device at a rate of 30,000 cu ft per hour. The merit factor for this operation is well above 50, a value exceeding the best figures for oxygen enrichment through burners by slightly more than 3 times.

Introducing oxygen through auxiliary burners is a new method, not previously described in the literature. Highest rate of heat transfer occurs when high intensity, high temperature flames impinge (*Please turn to page* 221)

Summary of Results with Oxygen in Electric Furnaces

	Jets		Lances	
Plant	**L**	**F**	**K**	**F**
Type of steel	alloy	alloy	low carbon	alloy
Size of heats, tons	33	71	77	68
No. of heats averaged	7	1	13	6
Production				
Tons per hour with O_2	4.4	...	10.3	...
Tons per hour without O_2	4.1	...	9.1	...
Per cent Increase	7.3	...	13.2	...
Oxygen Data				
Injection rate cfh	16,700	13,300	25,200	21,500
Operating time, min.	35	244	34	172
Operating pressure psi	85-95	62-70	...	...
Consumption in cf/ton	296	764	175	908
Consumption in cf/point/ton	18	6.2	5.2	16
Carbon Data				
Initial carbon points	21	130	58	...
Final carbon points	5	6.5	22.6	...
Carbon reduction points	16	123.5	35.4	57
Carbon reduction in points/min.	0.40	0.5	1.05	0.33
Charge to tap time with O_2	7.5	...	7.5	...
Charge to tap time without O_2	8.0	...	8.5	...
Merit factor	2.1	...	6.3	...
Power Data				
Kwh used/ton without O_2	970	...	615	...
Kwh used/ton with O_2	785	...	510	...
Per cent of total power saved	19%	...	17%	...

WELDING in the Iron

WELDING of gray cast iron is an old subject and much has been written on it. Industry has been welding cast iron for nearly 50 years and with exception of refinement in fluxes and electrode coatings little is known about the subject today that was not known 20 years ago. Because of the low price of castings and partly because of a distrust due mostly to the result of misuses of the process welding has made small headway in the cast iron foundry.

Now due to the present shortage and low quality of scrap iron many foundries are finding their rejections

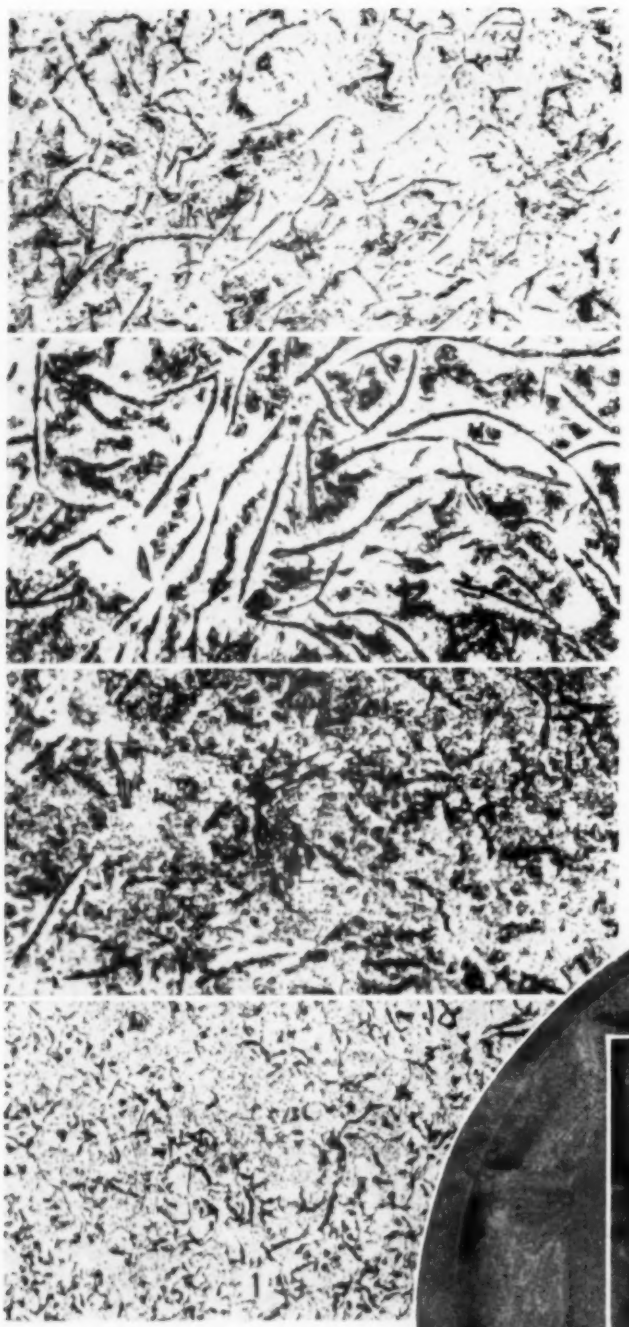


Fig. 1—Micrographs showing effect of welding speed on physical properties of welded joint. *A* (top panel)—Unaffected parent metal. *B* (second)—Heat affected area in sample welded with a No. 8 tip. *C* (third)—Heat affected area of weld made with No. 12 tip. *D* (bottom)—Structure of typical weld in cast iron

Fig. 2 — Iron casting with defects chipped out and prepared for welding. Close-up view of chipped areas shown in Fig. 3

Figs. 4 and 5—Illustrating heat-affected area of cast iron welded by metal arc process with nickel electrode. Shows effect of graphite size at fusion line

mounting steadily and are turning to welding as a method of repair. The purpose of this paper is to review the welding procedure applicable to iron foundry work and to point out some of the factors necessary to insure a successful repair welding program.

Available methods of repairing cast iron by welding are varied and many. However oxyacetylene welding with cast iron filler and metal arc welding with nickel or copper-nickel welding electrodes are methods which lend themselves most readily to foundry work. Relative merits of each process will be considered.

Oxyacetylene welding with cast iron filler is the fastest method of depositing metal and offers the advantage of sound deposits and identical color match in the welded area. Welds properly executed are readily machinable and free from defects. Chief disadvantages are the necessity of high preheats and controlled cooling rates and the difficulty in controlling distortion.

Defect to be welded should be removed by machining or chipping. A groove with a 90° Vee is adequate when chipping out cracks. Defects which extend through the

This discussion of requirements for successful welding of gray iron castings is from a paper presented at the seventh New England Foundry Conference held Mar. 28-29

Foundry

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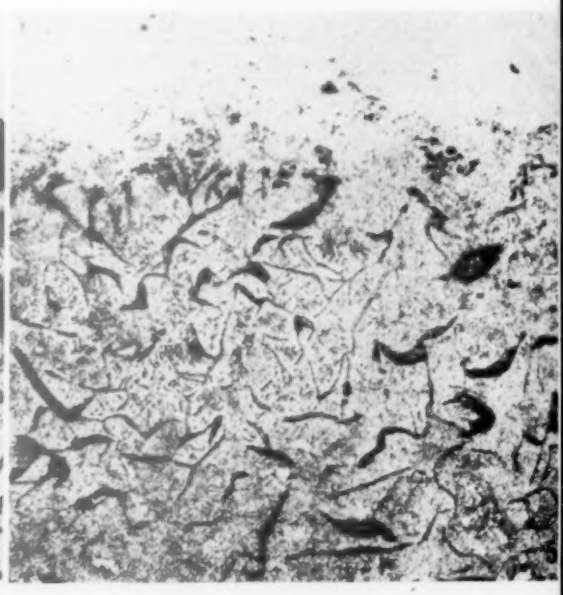
casting may be backed up with carbon blocks. Carbon block dams also are very helpful in making large build-up; they assist in keeping the weld metal within the desired limits while still maintaining a fluid puddle.

When oxyacetelyne welding is to be used, preheat is absolutely necessary to insure machinability in the weld. Large and complicated castings usually require preheating to reduce stresses which may induce cracking. General preheats ranging from 600 to 800°F with a local preheat of about 1000°F are usually satisfactory. Where the part to be welded is sufficiently isolated from the main body of the casting, only local preheat may be required.

In general, best results will be obtained by preheating in a furnace, although sufficient preheat can be obtained with a temporary furnace or in small parts by a torch. This latter method is expensive in man-hours and usually does not pay where the number of castings to be repaired is large.

On large repair jobs where the preheat must be maintained for long periods of time, it will be found beneficial to cover the castings with an insulating blanket such as asbestos. This also helps to protect the operator from the intense heat. A few strategically located gas burners will aid in maintaining the preheat temperature. On very large jobs it is frequently necessary to add heat in the area to be welded by an additional acetylene torch

Physical properties of a welded joint are affected by the speed of welding. A long application of heat will produce large graphite flakes in the heat-affected zone which reduce physical properties. Speed of welding therefore should be as rapid as possible for best physical properties. This effect is shown quite clearly in the photomicrographs of Fig. 1. Fig. 1*A* shows the structure of the unaffected parent metal. Figs. 1*B* and 1*C* are representative of the structure of the heat-affected area of two welded samples at the point of greatest change. Both samples were welded



under exactly the same conditions except that a larger torch was used for welding the sample from which Fig. 1*C* was taken, making greater welding speed possible.

Welds made by the oxyacetylene process when subjected to a tensile test usually will fail in the heat-affected area where the maximum growth of the graphite flakes has taken place. In the particular case mentioned, the parent metal had a tensile strength of 29,150 psi while B and C pulled at 18,250 and 27,700 psi, respectively.

Fig. 1*D* shows the microstructure of a typical oxyacetylene weld in cast iron. The flakes are small and well distributed and a large part of the carbon is in the combined state.

To hasten the welding operation, the torch selected should be as large as practical. The torch should be adjusted to a soft neutral or slightly carburizing flame. A harsh flame tends to drive gases into the weld metal and may result in a porous weld. Sometimes it is necessary to resort to water cooling of the torch, particularly in the larger sizes, to prevent flash-back and popping. A torch with water cooled tips may be purchased or a conventional torch may be adapted as shown in Fig. 6.

Fig. 6—Standard welding torch modified for water cooling

Fig. 7—Large iron casting repair welded by oxyacetylene process. Chalk lines show location of original crack

Filler metal for repair of gray cast iron is of a special analysis high in carbon and silicon to compensate for that burned out by the welding flame and to insure a machinable deposit. It is well to use a large filler rod when making large repairs. When the large sizes are not available, smaller sizes may be tacked together in bundles of two or more.

A little flux may be sprinkled in the groove at the starting point and the area to be welded brought to a melting temperature by the welding torch. When the sides of the groove have begun to melt, the end of the filler rod should be brought up to a red heat and dipped into the molten pool of metal. Moderate stirring of the puddle is necessary to work out impurities and trapped gases. Amount of additional flux required is determined by the consistency of the weld metal and the difficulty experienced in removing impurities. An experienced operator should have no difficulty in determining when addition of flux is necessary.

Casting Reheated After Welding

Weld metal should be deposited in rather heavy passes. Welding slightly uphill aids in preventing the molten metal from running forward over unfused metal and causing cold shuts. The cold end of the filler rod should not be introduced into the puddle, as there is some likelihood of the formation of hard spots. When completed the casting should be reheated to a temperature of approximately 1000°F to allow the stresses to equalize. Large castings generally are cooled in a furnace while small castings may be buried in lime, powdered asbestos or sand, and allowed to cool.

Fig. 7 shows a repair weld made on a large casting. The casting was covered with asbestos and preheated in the furnace to a temperature of about 800° F. When removed from the furnace, a number of gas torches were located inside the casting to help maintain the preheat. Welding was done in a single pass starting at the bottom. The area to be welded was preheated locally by the welding torches to about 1000° F before welding was started. Three operators were used in a rotating shift—one man welding, a second preheating the welding area with an additional torch and a third resting.

When completed the casting was returned to the furnace, reheated to approximately 1000° F and allowed to furnace cool. The chalk lines show the location of the orginal crack.

For many years, manufacturers of welding electrodes have been searching for an electrode which would deposit a machinable weld on cast iron by the metal arc process. The most successful have a nickel or nickel-copper core with a suitable coating. This process permits better control of distortion than is afforded by gas welding because the high preheat required for gas welding is eliminated and the peening applied as the weld progresses helps maintain dimensions.

An electrode of this type can be used to advantage on castings which have been partially or completely machined. The distortion usually encountered with gas welding is intolerable in this case and necessitates re-machining. The method is slow and tedious and hence is not a logical substitution where gas welding is practical.

In general, this process is not too dependable for welds requiring pressure tightness. (*Please turn to page* 136)

Control of Grain Size in Magnesium Casting Alloys

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and
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IT IS well known that castings of magnesium alloys tend to have a coarse-grain structure unless suitable steps are taken to insure the development of fine grains. The usual method for producing fine-grain structure has been to superheat the molten metal, a procedure initially described in 1931 in a British patent[1]. Superheating, in general, consists of heating a molten magnesium alloy to 250°-300°C above the liquidus and after holding it there for a required period, cooling to the desired temperature and pouring without delay. In recent years, with the increasing interest in magnesium casting alloys, other procedures have been proposed to accomplish this end and thereby avoid some of the disadvantages of superheating. Most of these involve treatment of the molten metal with carbon or a carbon compound.

Natural gas[2, 4], acetylene[2, 4], carbon monoxide[5], carbon dioxide[2, 5, 6], and a combination of chlorine and carbon tetrachloride[2, 3] have been recommended for bubbling through the molten metal. Mechanical agitation[4], both alone and together with additions of finely divided solid carbonaceous matter[6] like coal, peat, graphite, coke, etc., has also been proposed. A process involving noncarbonaceous materials is the German "Elfinal"[7] treatment of the molten magnesium with anhydrous ferric chloride.

Although numerous workers have investigated the problem of developing a fine-grain structure in magnesium castings, and many procedures have been recommended for the control of grain size, our knowledge of the actual mechanism involved is far from complete. The fact that superheating and carbon treatments produce similar results, and that both are effective only if aluminum is present, have suggested that a compound containing aluminum or aluminum and carbon may be essential; indeed, alumnium carbide has been used for controlling grain size.[2] It appears probable that during the treatment some slightly soluble substance is absorbed, and precipitates as very fine particles throughout the melt in the early stages of solidification to form the necessary nuclei. However, the identity of this substance has not been established. (*Please turn to page* 228)

Effect of Various Treatments of Molten Metal on Grain Size of Magnesium Casting, ASTM No. 4

Melt No.	Treatment	Grain Size (Average Diam, in.)	Type of Tensile Bar	Ultimate Ten Str, psi	Elongation (per cent)	Remarks
1	None	0.050	Machined	20,900	3½	
2	None	.020	Machined	23,100	4	Gas furnace
3	Superheated	.005	Machined	26,500	5	
4	Superheated	.004	Machined	27,600	5	Gas furnace
5	Superheated	.005	Machined	26,300	4½	Charge of remelt metal
5	Superheated	.005	Cast-to-size	30,100	6	
6	Granular graphite	.030	Machined	21,800	3	
7	Powdered graphite	.030	. . . .	. . . .	.	
8	Granular graphite	.014	Machined	23,900	4	Gas furnace
9	Silicon carbide crucible	.006	. . . .	. . . .	.	Coarse grain, remelt metal
10	Carbon monoxide	.005	Machined	27,800	5½	
11	Magnesite	.005	Machined	25,000	3	
12	Magnesite	.005	Machined	24,900	3	
13	Magnesite	.005	Machined	27,100	3½	
14	Magnesite	.005	Machined	26,100	3½	
15	Magnesite	.006	Machined	23,900	3	
16	Magnesite	.005	Machined	26,300	3½	Coarse grain, remelt metal
17	Magnesite	.004	Cast-to-size	29,800	6	Miscellaneous remelt metal
18	Magnesite	.004	Cast-to-size	30,600	6½	Miscellaneous remelt metal
19	Magnesite	.006	Cast-to-size	29,000	5½	Miscellaneous remelt metal
20	Magnesite	.005	Cast-to-size	27,900	5	Miscellaneous remelt metal
21	Magnesite	.005	Cast-to-size	29,000	5½	Miscellaneous remelt metal
22	Magnesite	.005	Cast-to-size	30,200	6½	Miscellaneous reemlt metal
23	None	.040	Cast-to-size	. . . .	.	Remelt of castings from Melt No. 3
24	None	.025	Cast-to-size	. . . .	.	Remelt of castings from Melt No. 10
25	None	.070	Cast-to-size	23,000	4	Remelt of castings from Melt No. 22

HOW TO PREVENT Snagging Wheel Breakage

Proper mounting of wheels and flanges are discussed in this second and concluding article outlining methods of preventing snagging wheel breakage

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WHEN snagging wheels break in operation and the causes are not immediately apparent, the trouble usually can be traced back to faulty mounting equipment or method. That is probably the largest single real reason for wheel breakage. Some abrasive engineers think that it accounts for at least half of all breakage in operation.

Strangely enough, it seems necessary to start a discussion of proper mounting methods by stating that flanges are essential parts of wheel mountings, that wheels should always be mounted between *two* flanges, and that the flanges should be of the same diameter. Yet, most abrasive engineers who have investigated wheel breakage have seen wheels mounted without flanges, with a flange on one side and a nut on the other, or with one flange larger than the other. It should be evident that any of those blunders will set up stresses in the wheel that it was not designed to stand.

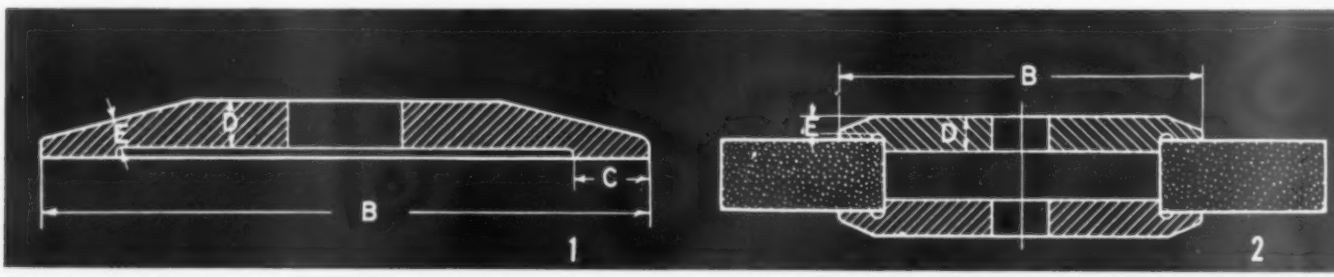
Flanges used in snagging are of two basic types—straight and protection. Straight flanges have no protective function and may be used only when some standard protection device such as a hood is used. They are intended only to support and drive the wheel.

TABLE I

A	B	C		D	E
Diameter of Wheel Inches	Minimum Outside Diameter of Flanges Inches	Radial Width of —Bearing Surface— Minimum Inches	Maximum Inches	Minimum Thickness of Flange at Bore Inches	Minimum Thickness of Flange at Edge of Recess Inches
4	1¼	1/16	3/8	1/16	1/8
5	1½	1/16	3/8	1/4	1/8
6	2	1/4	1/2	3/8	1/8
8	3	1/4	1/2	3/8	1/8
10	3½	1/16	5/8	3/8	1/4
12	4	1/16	5/8	1/2	1/8
14	4½	5/8	3/4	1/2	1/8
16	5½	1/2	1	1/2	1/8
18	6	1/2	1	5/8	3/8
20	7	5/8	1¼	5/8	3/8
22	7½	5/8	1¼	5/8	1/2
24	8	3/4	1½	5/8	1/2
26	8½	3/4	1¼	5/8	1/2
28	10	7/8	1½	5/8	1/2
30	10	7/8	1½	3/4	5/8
36	12	1	2	7/8	3/4

TABLE II

Wheel Diameter Inches	Hole Diameter Inches	B Minimum Flange Diameter Inches	D Minimum Thickness of Flange at Bore Inches	E Minimum Thickness of Flange at Edge of Recess Inches
12	4	6	5/8	3/8
to	3	7	5/8	3/8
14	6	8	5/8	3/8
Larger than	4	6	5/8	3/8
14	5	7	5/8	3/8
to	6	8	5/8	3/8
18	7	9	5/8	3/8
	8	10	5/8	3/8
	6	8	3/4	1/2
Larger than	7	9	3/4	1/2
18	8	10	3/4	1/2
to	10	12	3/4	1/2
24	12	14	3/4	1/2
Larger than 24 to 36	12	15	3/4	1/2



Protection flanges are usually of the tapered type. The Safety Code provides that protection flanges *must* be used if no other kind of protection is provided. In addition to affording protection against injury and damage if the wheel breaks, they also serve to hold and drive the wheel, as do straight flanges. Protection flanges of the taper type must be used only with tapered wheels designed to fit the flanges.

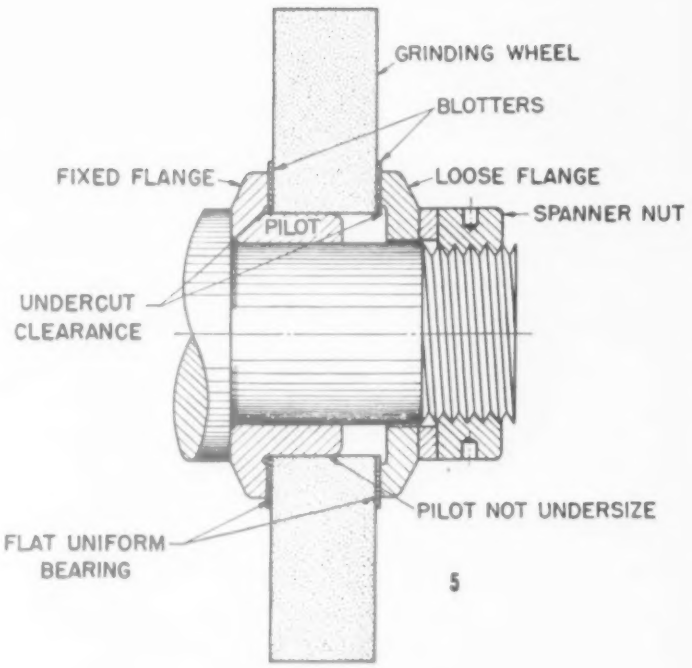
The various types of flanges are shown in Figs. 1, 2, 3, 4, 8 and 9. Minimum dimensions for flanges of the sizes used for snagging are shown in Tables I, II, III, IV and V.

Much wheel breakage is due to using flanges which are too small in one or more dimensions. The dimensions shown in the tables are minimums. No harm is done by having new flanges oversize.

Most of the mounting faults that result in wheel breakage are common to all types of mounts. Since the component parts of the commonly used sleeve type adapter mounting for large hole wheels, shown in Fig. 5, are subject to all of the possible mounting faults, including a few peculiar to itself, we shall, to save space, confine our discussion to that type of mount. Future references in this text are to Fig. 5 unless others are specified.

To keep the wheel from slipping between the flanges, adequate flange pressure must be exerted and there must be flat, uniform bearing of both flanges against the sides of the wheel—through a "blotter" of course. In order to play safe against possible wheel slipping, many operators have a tendency to apply so much initial flange pressure as to be entirely unsafe from the point of view of wheel breakage.

The excessive initial pressure defeats its own purpose, as shown in Fig. 6, by springing the flange so that there is inadequate contact between wheel and flange, and the wheel begins to slip. That too often is taken as a signal to tighten the flange still further to stop the slipping.



Figs. 1-4—Various types of flanges used with snagging wheels. Corresponding tables give principal minimum dimensions

Fig. 5—Properly mounted wheel and flanges

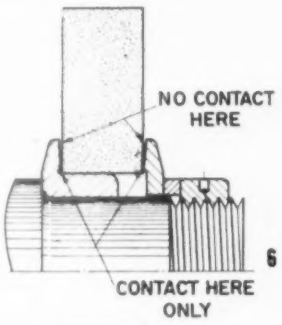


Fig. 6—Sprung flange, caused by too much initial pressure, gives inadequate contact between wheel and flange and results in wheel slippage

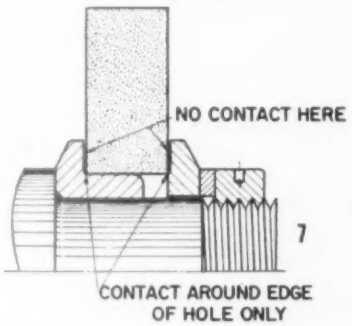


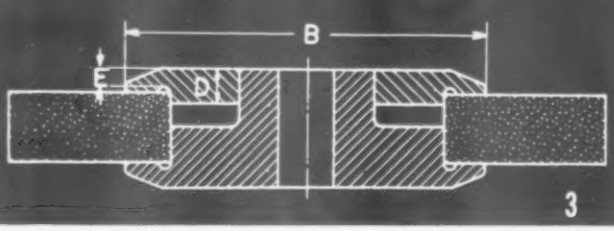
Fig. 7—Further tightening of flange results in all of the contact being at edge of wheel hole

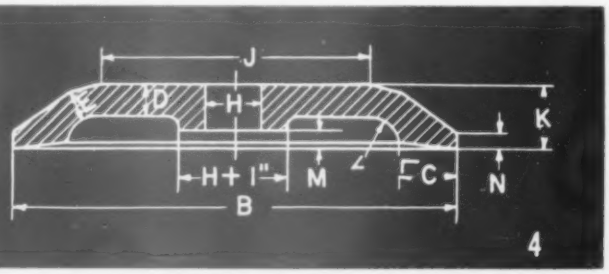
TABLE III

Wheel Diameter Inches	Wheel Hole Inches	B Minimum Outside Diameter of Flange Inches	D Minimum Thickness of Flange at Bore Inches	E Minimum Thickness of Flange at Edge of Recess Inches
12 to 14	5	7	½	7/16
	5	7	5/8	7/16
	6	8	5/8	7/16
Larger than 14 to 20	8	10	5/8	7/16
	10	11½	5/8	7/16
	12	13½	5/8	7/16
	8	10	¾	½
Larger than 20 to 30	10	11½	¾	½
	12	13½	¾	½
	16	17½	¾	½
	12	13½	¾	½
Larger than 30 to 36	16	17½	¾	½
	18	19½	¾	½
	20	21½	¾	½

TABLE IV

Diam of Wheel In.	Thickness of Wheel In.	B In.	C Max In.	C Min In.	D In.	E In.	J In.	K In.	L In.	M In.	N In.
16	4	10	1½	1	¾	¾	6	1½	¾	7/16	3/8
18	4	12	2	1½	7/8	7/8	6	2	7/8	3/8	3/8
20	4	14	3	2	1	1	7	2¼	1	7/16	3/8
24	4	18	4	3	1¼	1¼	8	3	1½	7/16	3/8
30	4	24	5	3½	1½	1½	10	4	2	¾	3/8





the wheel loses still more contact, more pressure is applied and so on until all of the contact is at the edge of the wheel hole (Fig. 7). That sets up far too heavy stresses on the wheel, and the wheel breaks.

Unless flanges are much thicker than shown in the tables, excessive pressure is sure to spring them, for the thicknesses shown presuppose using only enough pressure to prevent slipping.

Even the minimum required pressure is often enough to spring new flanges. This is usually due to using flanges that were not designed for heavy duty, high-speed snagging on modern machines.

But most often when flanges spring under proper pressure the trouble is that the flanges have been worn or retrued to the point where the thickness has been reduced below the required minimum shown in the tables. Such flanges should be replaced with new, full-size ones, or built up with welding rod or spray metal and then retrued.

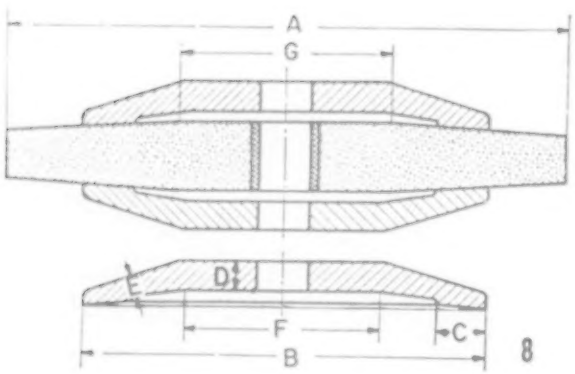
To determine whether there is a tendency to overtighten flanges, frequent inspections of mounts should be made. The inspection consists simply of trying to insert a thin feeler gage between wheel and flange. If the flange is true and the pressure correct the feeler gage will not enter. If it does, the amount of excess pressure can be indicated by trying successively thicker gages. Unfortunately, this test cannot always be used when there are blotters between wheel and flanges.

Nor does it show whether the flanges have become out of true for any reason, so that they do not bear evenly against the sides of the wheel under proper pressure. Testing the squareness of the pilot with the flange face by means of a steel square may not be truly indicative because the pilot may be slightly tapered. The following inspection method is suggested by the Safety Committee of the Grinding Wheel Manufacturers Association:

"Make a dummy wheel of cast iron or other durable material. The thickness should be the same as the thickness of the wheel, and the sides should be parallel and reasonably smooth. The diameter should be about 1 in. larger than the outside diameter of the flanges and the bore should be an easy sliding fit on a full-size pilot.

"This dummy should be mounted in place of a wheel and the nut drawn up just enough to be a good contact. Inspection with a feeler gage will tell whether the flanges are worn or permanently sprung so that they are no longer flat. Both flanges should contact the sides of the dummy all the way around, and it should not be possible to insert even a thin feeler gage at any point around the flanges. If the contact is not good, the flanges should be repaired as indicated.

"If the flanges are found to contact the sides of the dummy satisfactorily, they should then be tightened as much as is customary when mounting a grinding wheel. The feeler gage inspection should then be repeated. If there was good contact between the flanges and the dummy before tightening, and if the feeler gage can be inserted after tightening, this is proof that the flanges are being sprung either by excessive tightening or because they are too thin. If they are as thick as standard, the springing must be due to too (*Please turn to Page* 194)



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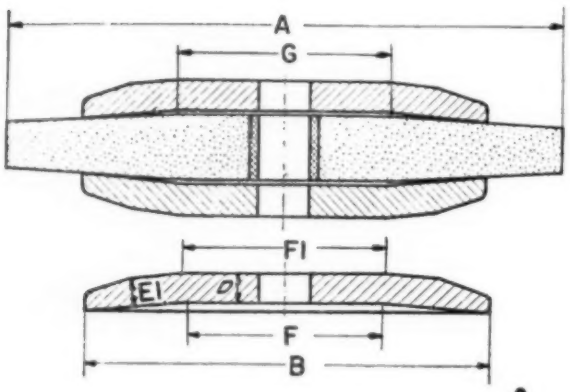

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Figs. 8-9—Protection flanges of the taper type used with tapered wheels. These flanges serve not only to hold and drive the wheel, but also afford protection against injury and damage if the wheel breaks

TABLE V

A	B	C		D	E	E_1	F	F_1	G
Diam of Wheel Inches	Min Outside Diam of Flanges Inches	Radial Width of Bearing Surface Fig. 8 Only Min Inches	Max Inches	Min Thickness of Flange at Bore Inches	Min at Edge of Recess Fig. 8 Only Inches	Min Thickness at Bevel Fig. 9 Only Inches	Max Flat Spot at Center of Flange Inside Inches	Diam of Flat Area Outside Fig. 9 Only Inches	Max Diam of Flat Spot or Hub of Wheel Inches
6	3	⅛	⅛	⅜	1/16	..	0	..	1
8	4	1/16	⅝	⅜	⅛	..	0	..	1
10	5	⅛	1	½	¼	..	0	..	2
12	6	½	1	⅝	1/16	½	4	5	4½
14	8	⅝	1¼	⅝	⅜	½	4	5	4½
16	10	¾	1½	⅝	⅜	½	4	6	6
18	12	1	2	¾	½	⅝	4	6	6
20	14	1¼	2½	¾	½	⅝	4	7	6
22	16	1⅜	2¾	¾	1/16	⅝	4	7	6
24	18	1½	3	¾	1/16	⅝	4	8	6
26	20	1½	3¼	¾	⅝	⅝	4	8	6
28	22	1⅝	3⅜	⅞	⅝	⅝	4	8	6
30	24	2	4	⅞	¾	¾	4	8	6

BLOWING High Manganese Metal

In a Side Blown Converter

By JOHN HOWE HALL
Swarthmore, Pa.

IN 1913, before the introduction of electric steelmaking furnaces, the "Hadfield" 12 per cent manganese steel made for castings in this country was produced by mixing in a ladle, molten 80 per cent ferromanganese and soft steel from a converter or tilting open-hearth furnace. Several of the producers operated side blown converters, and had never been able to reuse their heads, gates and defective castings. They had to sell this scrap at a very low figure, for the most part to dealers who furnished scrap to the open-hearth shops.

Then, as now, it was thought to be impossible to blow in a side blown vessel, metal containing much over 0.80 per cent, or at the very most 1 per cent, manganese. When the manganese content of the metal charged to the converter exceeded that figure, very violent boiling and explosive "slopping" of the charge was the inevitable result. As a result, the manganese content of converter charges in side blown practice was usually restricted to 0.60 per cent.

The author came to the conclusion, some time in 1913, that a possible cure for this difficulty was to use very high proportions of manganese in the converter charge, somewhat on the theory of "a hair of the dog that bit you" as a cure for dog-bite. His theory was that if the slag produced in the early stages of a converter blow could be made to contain about 60 per cent MnO and 40 per cent SiO_2, it would be continuously fluid, and would react with the carbon of the bath at frequent intervals, so that no violent boil would occur. According to this view, the boiling of a converter charge of normal composition occurs only at intervals because it is only when the FeO content of the slag has been greatly increased, that the slag becomes sufficiently fluid to mix freely with the metal and start a reaction between the FeO of the slag and carbon of the metal. During that boil, the FeO of the slag is so reduced by reaction with carbon that the slag becomes semisolid, and no further boil occurs until the FeO content of the slag is built up again.

Should this theory be proved correct, it was thought that it would be possible to utilize large proportions of 12 per cent manganese steel scrap in converter charges. Though the manganese would be lost, yet a money saving would result, since the price at which manganese steel scrap was being sold was ruinously low.

Accordingly, several experimental blows were run in a 2-ton converter. The details of the cupola charges, etc., are shown in the accompanying tables. As will be seen, in the first of these experiments a charge containing slightly over 4 per cent manganese and 1.90 per cent silicon was successfully blown, with no explosive slopping or boiling over of the metal. Several times during the blow, a moderately active boil occurred, but little slag and no metal were thrown out of the vessel. The sulphur content of the steel made was 0.017 per cent, probably a record for converter steel in those days, when the fused soda-ash treatment had not even been thought of. The phosphorus, of course, was rather high, since 12 per cent manganese steel contained in those days an average of about 0.08 to 0.09 per cent phosphorus.

As the author wished to apply this principle to charges containing somewhat less manganese steel scrap, so that foundries not making manganese steel could use this cheap scrap as part of their cupola charges, two blows were made with the mixtures shown as blows Nos. 2 and 3. These charges were calculated to give slags containing about 60 per cent MnO and 40 per cent SiO_2, but both the silicon and the manganese of the metal were considerably lower than in blow No. 1. Possibly because not enough heat was developed from the combustion of these lower amounts of silicon and manganese, both these blows slopped over explosively, so that the vessel had to be turned down and 500 or 600 lb more cupola metal added, in order to continue blowing.

To ascertain whether the success of the first blow was merely a matter of luck, blow No. 4 was made, with a charge of nearly the same composition as that used for blow No. 1. This blow behaved almost exactly like the first one, no explosive boil taking place and no metal being ejected from the converter. As in the first experiment, the sulphur of the steel made was exceedingly low (0.019 per cent).

Some years later in March, 1922—the author made a blow in a 2-ton converter, using a cupola charge of approximately 50 per cent manganese steel scrap and 50 per cent pig iron. The metal charged to the vessel was not analyzed, but was estimated to contain about 1.90 per cent silicon and 4 per cent manganese. This charge blew exactly like blows Nos. 1 and 4 of the earlier experiment, several mild boils occurring, but no slopping over took place and no metal was thrown out of the vessel. The steel produced analyzed as follows: C 0.45, Si 0.32, Mn 0.64, P 0.082, and S 0.026.

A U. S. patent, No. 1,249,075, now long expired, covered the general principle illustrated by these experiments.

Of course, the slag produced in these blows was very black, fluid and corrosive, because of the high proportion of MnO it contained. Such a slag would undoubtedly attack severely the usual ganister or silica brick lining of the side blown converter, and would necessitate the use of (*Please turn to page* 232)

Effect of MOLD MATERIAL on Gas Absorption by 85-5-5-5 ALLOY

By L. W. EASTWOOD
Assistant Supervisor
and
J. G. KURA
Research Engineer
Battelle Memorial Institute, Columbus, O.

GAS absorption by the melt in the mold cavity just prior to solidification is a problem of great practical importance. It is well known, for example, that under some conditions aluminum alloys will absorb large amounts of hydrogen from the moisture evolved from green sand. This is particularly noticeable when high moisture is employed in combination with a low AFA permeability of 5 to 10. Under these conditions, the steam generated in the mold actually develops sufficient pressure to break the oxide skin surrounding the melt. When this occurs, the tops of the risers will be observed to quiver while the casting solidifies. The steam generated reacts with the aluminum to form Al_2O_3 and nascent or atomic hydrogen. The atomic hydrogen is very rapidly absorbed by the melt, and it is possible for large quantities of it to be dissolved by the melt in a few seconds prior to solidification. Thus, the results of a careful melting and metal handling technique, designed to avoid or eliminate gas absorption, may be partially or entirely nullified by the gas absorption just prior to solidification in the mold cavity.

Gas absorption by copper-base alloys from the mold materials into which they were poured was noted by Lepp.[52] More recent work has been done by Pell-Walpole[18] and by members of the British Non-Ferrous Research Association, who have shown that gas is absorbed by copper-base alloys from the mold or similar material. A fairly complete account of the work done by Pell-Walpole was described in the third article of this series.

When investigating the problem of test bars for the

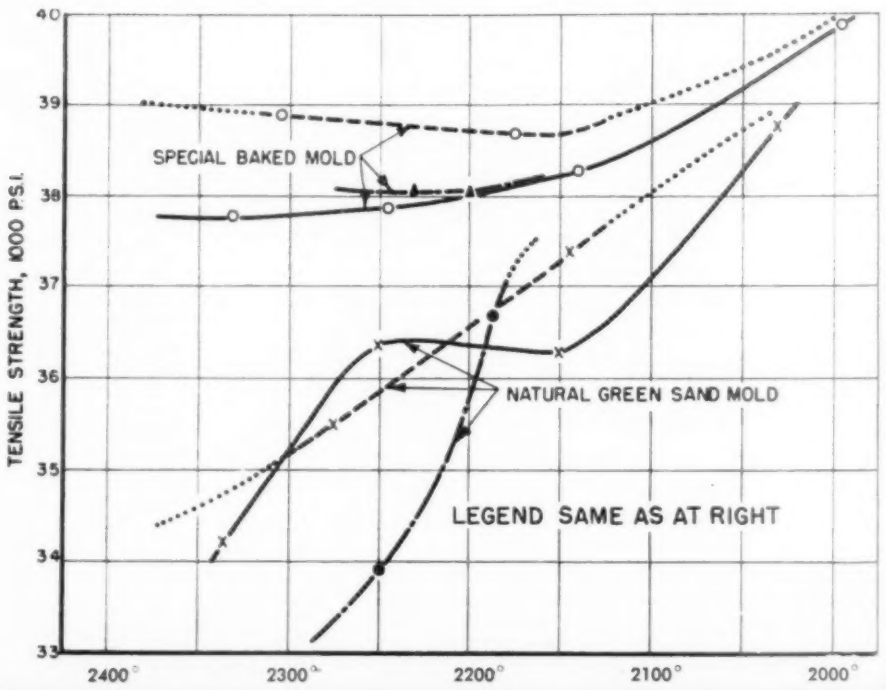


Fig. 19—Tensile properties of 85-5-5-5 alloy prepared in a silica-lined high-frequency induction furnace and poured into single-cavity natural green sand molds and double-cavity special baked molds

copper-base alloys, it is obviously necessary to determine the effects of such variables as moisture content and AFA permeability of the sand employed. This was done by preparing a series of molds similar in all respects, excepting that (1) the moisture content was varied from a practical minimum to as high a value as possible, or (2) the AFA permeability was varied from a relatively low value to a relatively high value. A series of molds having these variations in moisture content or permeability was poured from a single melt of 85-5-5-5 alloy. If the first melt was poured in the molds having an increasing moisture content from beginning to end, a second heat was prepared and poured into a series of molds in which the moisture content decreased from the beginning to the end of the pour. Thus, by using the average results of the duplicate melts and having the variable increase for one heat and decrease for the other, the effects of pouring temperature were substantially eliminated.

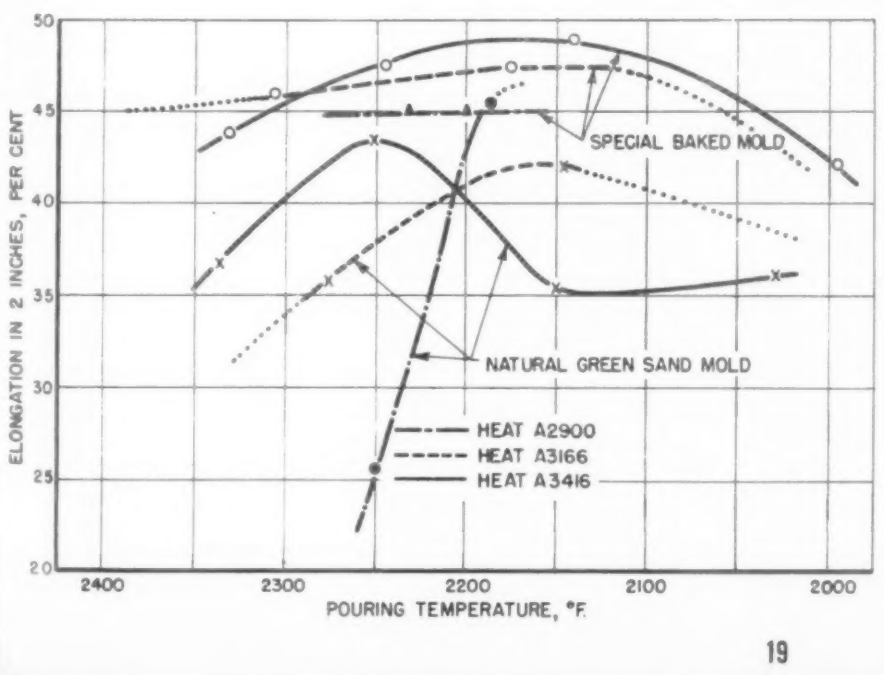
Effect of Moisture Content in Natural Sand—Using this technique, several melts were poured into natural green sand molds having a permeability in the range of 13 to 17 and a range in moisture content of about 5.5 to 10 per cent. The results are listed in Table VIII. This table contains data on test-bar properties obtained at a low and at a high moisture level. As indicated in the table, four different test bar designs were employed, the Horizontal 5/8-in. web Webbert, the Modified 5/8-in. web Webbert, the Modified 5/8-in. web Crown, and the keel block, detailed drawings of which have been published elsewhere.[31] In general, the results indicate that the test bar properties are not sensitive to the moisture content of the natural green sand. There is some indication that lower properties were produced in the Horizontal 5/8-in. web Webbert at the higher moisture content. However, the Modified 5/8-in. web Webbert and Modified 5/8-in. web Crown showed practically identical properties in skin-dried molds as in molds containing 5.8 to 6.8 per cent of water or 9 to 10 per cent water. This does not mean that gas is not absorbed from such green sands, it only indicates that the amount of gas absorbed from the test-bar mold is not noticeably dependent upon the moisture content of the natural sand employed.

Tensile properties and soundness of 85-5-5-5 test bars are highest when metal is poured in synthetic sand molds baked at 1600 or 1700° F, it is indicated in this sixth of a series of articles based on investigations sponsored by the Non-Ferrous Ingot Metal Institute

Effect of AFA Permeability—The effect of the AFA permeability in both natural sand and in synthetic sand was investigated. A variation in permeability of the natural sand was obtained by mixing various proportions of natural Tennessee green sands, one of which had high permeability and the other a low permeability. The variation in the AFA permeability of the synthetic sand was obtained by bonding two different clean silica sands, one fine and the other fairly coarse, with 6.5 per cent fire clay and 2 per cent western bentonite, and about 3.5 per cent water. One heat was poured into a series of molds having a permeability increasing from mold to mold, from a low value to a high one. The second heat was cast in reverse order so that the high-permeability molds were poured first. As indicated previously, the average results of the two heats helped to eliminate the effects of pouring temperature on the properties obtained.

Several heats were prepared and poured into a series of molds of varying permeability as described and the results are listed in Table IX. As this table indicates, the effect of permeability of both natural and synthetic sands on the test bar properties was determined on the Horizontal 5/8-in. web Webbert and the keel block castings. These two castings represent a considerable difference in weight, the keel block, of course, being the heavier of the two.

When the keel block was poured in any sand or when the Horizontal 5/8-in. web Webbert was poured in other than a natural sand having a permeability of 20 to 40, and 6 per cent water, a so-called standard test casting was poured in order to check the melt quality. This standard test casting was the Horizontal 5/8-in. web Webbert poured into a natural sand containing 6 per cent water and having an AFA permeability of 20 to 40. At a pouring temperature of 2070 to 2190°F, tensile properties of about 38,000 psi and 40 per cent elongation indicate that a melt of high quality was being used. These results, listed in Table IX, indicate that the AFA permeability in either the synthetic or natural sand has relatively little or no effect on the test bar properties obtained in



either the Horizontal ⅝-in. web Webbert or keel block castings, though there is a slight indication that an increasing permeability has a beneficial effect upon the tensile properties of the keel block cast in the natural sand.

Again it must be concluded that AFA permeability of the green sand has very little, if any, effect upon the tensile properties obtained in these test castings poured in the temperature range employed. However, this does not mean that gas is not absorbed from the test bar mold material, but that the amount of the gas, if any is absorbed, is not particularly dependent upon the AFA permeability number or other sand characteristics in the mold.

Effects of Baking Temperature and Type of Bond—It will be observed from the data in Table IX that, when the metal is poured in natural green sand, very much higher tensile properties are obtained in the Horizontal ⅝-in. web Webbert test bar than is obtained when the same metal is poured in synthetic sand. On the other hand, the test bar properties of the keel block are about the same in either type of sand. Apparently, the adverse effect of the sand has little or no effect upon the properties of the keel block as the latter is characterized by a high degree of unsoundness and rather coarse, angular lead particles, both of which tend to produce low properties, regardless of the melt quality or the type of mold used.

Further work along this line was undertaken and various types of molds were poured from duplicate heats.

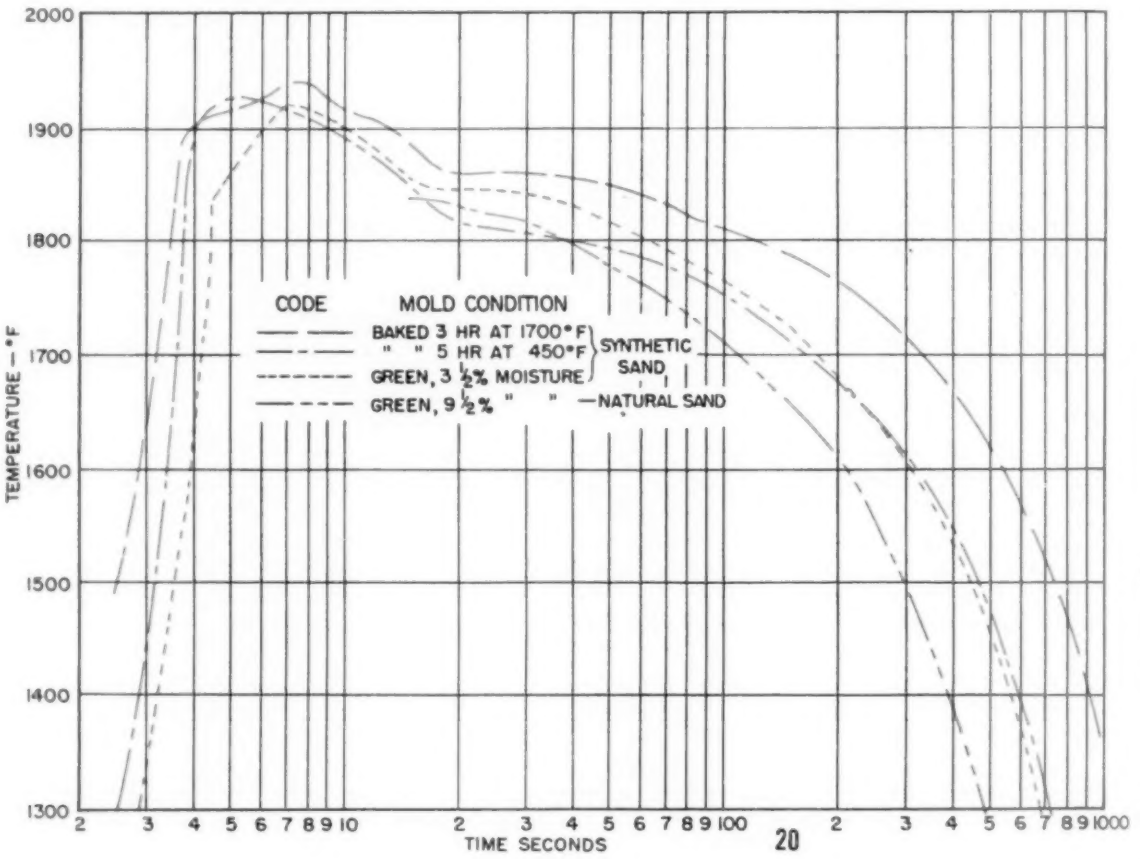


Fig 20—Effect of various mold materials on cooling curves of 85-5-5-5 alloy at web section of ⅝-in. web Webbert bar poured at 2150° F. Heat—A 1092

TABLE VIII—Effect of Moisture Content of Natural Sand** on Test Bar Properties of 85-5-5-5 Alloy*

No. of Bars	No. of Heats	AFA Perm.	Per Cent H_2O	T. B. Design	Pouring Temp., °F	Tensile Strength, psi	Elongation in 2 in. Per Cent
8	2	16-18	5.5-6.0	Hor. ⅝" w-W	2090-2150	37,800	45.9
12	2	16-18	7.8-9.5	Hor. ⅝" w-W	2090-2150	38,100	40.5
12	2	16-17	5.8-6.8	Hor. ⅝" w-W	2090-2170	38,100	44.7
8			9.0-10.0	Hor. ⅝" w-W	2090-2170	38,175	37.2
4			Skin dried	Hor. ⅝" w-W	2095-2170	38,100	47.3
12	2	16-17	5.8-6.8	Mod. ⅝" w-W	2090-2170	37,300	37.1
8			9.0-10.0	Mod. ⅝" w-W	2090-2170	38,050	37.2
4			Skin dried	Mod. ⅝" w-W	2095-2170	37,600	37.6
12	2	16-17	5.8-6.8	Mod. ⅝" w-Crown	2090-2170	39,200	36.0
8			9.0-10.0	Mod. ⅝" w-Crown	2090-2170	38,900	36.4
4			Skin dried	Mod. ⅝" w-Crown	2095-2170	39,100	37.5
2	1	17	6.0	Hor. ⅝" w-W	2170	37,800	52.7 (Standard)
2	1	17	5.8	Keel block	2170	34,200	28.2
3	1 (Standard)"	13-15	8.0-10.2	Keel block	2120-2090	36,250	30.6

* Melts prepared in a silica-lined high-frequency induction furnace, using 50 per cent secondary ingot and 50 per cent foundry scrap; ¼ per cent zinc, and 2 ounces of 15 per cent phosphor copper were added to the ladle during the transfer.

** Natural sand from Tennessee.

Again, the order of these various types of molds was reversed for the two heats so that the average results would substantially eliminate the effects of pouring temperature. The results of this investigation are listed in Table X. The data in this table are based on the results of duplicate heats from which four different castings were poured in each type of mold material, making eight bars for each condition. Examination of these data shows that the highest properties and soundest fractures are obtained in a synthetic sand baked at 1700°F. The next best properties are obtained in the natural green sand, having an AFA permeability of 20 at 6 per cent water.

The other four mold materials all produced similar but comparatively low results. It is especially interesting to note that the synthetic sand bonded with 2 per cent western bentonite and 6.5 per cent fire clay produced about the same low properties when it contained 3.5 per cent water as it did when the same mold material was baked for 5 hours at 450°F. It is only when this mold material is baked at 1700°F that the very high properties are obtained.

Table XI contains data on additional Horizontal ⅝-in. web Webbert test bar castings poured in various mold materials at a pouring temperature of 2150°F. These results again show the superiority of the synthetic sands baked at 1700°F, with the natural green sand second, and the synthetic sands either not baked at all or baked at 450°F being generally the poorest. From Tables XI and XII, it is interesting to note that if the test bars poured in synthetic sand molds baked at 1700°F are taken as sound, then the following shows the relative average per cent voids in the castings made in the various molds:

Synthetic sand, baked at 1700° F.	0.0% voids (assumed)
Synthetic sand, green	1.3% voids
Natural green sand	1.8% voids
Synthetic sand, baked at 450°F.	2.2% voids

While it will be observed that the synthetic green sands produced consistently higher densities than did the natural green sands, the tensile properties of the former are lower, the fracture is less sound, and the fracture invariably occurs in the shoulder. Presumably, the unsoundness that causes the poor fracture and relatively low tensile properties in test bars cast in synthetic green sands is quite localized in the shoulder of the bar. Further investigation will be necessary to determine the exact cause of this localized unsoundness.

In this connection, it is interesting to note that density measurements on the (1) entire half of the test bar, in-

TABLE IX—Effect of AFA Permeability of Natural and Synthetic Green Sands on the Test Bar Properties of 85-5-5-5 Alloy*

No. of Bars	No. of Heats	Sand** Type	AFA Perm.	Moisture Per Cent	T. B. Design	Pouring Temp., °F	Tensile Strength, psi	Elongation in 2 in. Per-Cent
8	2	Natural	19-26	6.0	Hor. ⅝" w-W	2090-2150	38,400	40.1
8	2	Natural	86-117	6.0	Hor. ⅝" w-W	2090-2150	38,400	35.8
8	2	Natural	11.8-15.2	7.0	Hor. ⅝" w-W	2055-2185	37,800	37.3
16	2	Natural	46-54	7.0	Hor. ⅝" w-W	2055-2185	38,400	37.2
4	2	Natural	12.6	6.5	Keel block	2040-2150	28,000	16.0
4	2	Natural	80.0	6.5	Keel block	2040-2150	30,300	19.7
2	2	Natural	20.0	6.5	Hor. ⅝" w-W	2150	36,800	40.3 (Standard)
6	2	Natural	15.2	7.0	Keel block	2065-2170	29,100	15.6
6	2	Natural	63.0-138.0	7.0	Keel block	2065-2170	31,000	20.2
4	2	Natural	20	6.0	Hor. ⅝" w-W	2070-2175	38,000	42.2 (Standard)
16	2	Synthetic	14.7-22.7	3.4	Hor. ⅝" w-W	2090-2180	35,800	27.9
20	2	Synthetic	85-142	3.4	Hor. ⅝" w-W	2090-2180	36,150	29.4
2	2	Natural	20	6.0	Hor. ⅝" w-W	2190	37,200	40.1 (Standard)
8	2	Synthetic	12.6	3.4	Hor. ⅝" w-W	2060-2160	36,700	32.2
16	2	Synthetic	96-138	3.4	Hor. ⅝" w-W	2060-2160	36,500	28.8
4	2	Natural	20	6.0	Hor. ⅝" w-W	2105-2170	37,900	43.1 (Standard)
4	2	Synthetic	14.7	3.4	Keel block	2050-2160	29,200	20.0
6	2	Synthetic	134	3.4	Keel block	2050-2160	28,300	18.6
4	2	Natural	20	6.0	Hor. ⅝" w-W	2140-2180	36,600	40.5 (Standard)

* Melts prepared in a silica-lined high-frequency induction furnace, using 50 per cent secondary ingot and 50 per cent foundry scrap; ¼ per cent zinc, and 2 ounces of 15 per cent phosphor copper were added to the ladle during the transfer.

** Natural sand from Tennessee. Synthetic sand consisted of clean silica sand bonded with 6.5 per cent fire clay and 2 per cent western bentonite.

TABLE X—Effect of Mold Material on the Tensile Properties Obtained in the Horizontal ⅝-in. Web-Webbert Test Bar*

Mold Condition	Pouring Temp., °F	Tensile Strength, psi Minimum	Tensile Strength, psi Average	Tensile Strength, psi Maximum	Elongation, Per Cent Minimum	Elongation, Per Cent Average	Elongation, Per Cent Maximum	Fracture** Rating, Code	Density*** Minimum	Density*** Average	Density*** Maximum
Natural green sand, AFA permeability 38	2090-2180	37,200	38,600	40,100	36.8	42.6	51.5	2C	8.79	8.83	8.86
1% oil, 1% cereal baked at 450° F	2085-2180	34,300	36,900	39,500	27.6	32.0	41.3	2C to 2A	8.67	8.74	8.86
2% cereal baked at 450° F	2095-2170	35,100	36,400	37,700	25.6	31.0	35.9	2B	8.48	8.66	8.74
2% western bentonite + 6.5% fire clay, not baked, AFA permeability 108	2105-2160	37,700	38,100	38,500	31.4	33.5	35.6	2B	8.75	8.82	8.88
2% western bentonite + 6.5% fire clay, baked at 450° F	2110-2145	33,400	36,250	37,800	22.6	31.4	38.1	2B	8.80	8.83	8.85
2% western bentonite + 6.5% fire clay, baked at 1700° F	2110-2155	37,700	38,650	40,000	41.5	45.2	50.8	1 to 2C	8.88	8.89	8.90

* A 350-lb charge, consisting of 50 per cent gates and risers and 50 per cent new ingots of 85-5-5-5 alloy, was melted in silica-lined, high-frequency induction furnace. No cover was used. The melt was transferred to a pouring ladle after skimming. An addition of 1¼ per cent zinc and 2 ounces of phosphor copper per 100 lb of melt was made during the transfer. Two heats were prepared and poured at the temperature indicated. Each average is from data on eight bars. All synthetic green sand and core mixes were prepared from the same clean silica sand.

** 1 Indicates a sound fracture. 2C Indicates a fairly sound fracture. 2B Indicates a moderately sound fracture. 2A Indicates an unsound fracture.

cluding the grip end, and on (2) the same bar, but the test section only, produced the following results:

TABLE A

Bar No.	Mold Material	Density—Half of Bar After Fracture	Density—Half of Bar Before Fracture	Density—Test Section Only After Fracture	Density—Test Section Only Before Fracture
A-3166A	Calcined clay baked at 1600° F	8.88	8.91*	8.82	8.91*
A-3166C	Synthetic green sand	8.67	8.70*	8.73	8.82*
A-3166D	Natural green sand	8.58	8.61*	8.58	8.67*

* Estimated on the basis of density measurements before and after fracture of several other similar bars.

It will be observed that the estimated density of the test section prior to testing the bar cast in synthetic green sand is quite high and approaches that obtained in calcined clay baked at 1600°F. However, the poor tensile properties and rather unsound fracture are a result of localized unsoundness in the shoulder of the bar, causing the fracture to occur invariably at this location. Since the overall density of the bars cast from high-quality metal into synthetic green sand is high and the density of the test section is even higher, it is not logical to assume that the localized unsoundness in the shoulder is caused by gas absorption from the mold. Such localized unsoundness in the shoulder of the bar is more likely to be caused by microporosity accentuated by poor feeding, as described in the first article of this series.

Table XII shows the tensile properties and densities of the Horizontal 5/8-in. web Webbert test bar poured into various mold materials over a range in temperature, employing melts of high quality. Again, the synthetic sand was prepared from a clean silica sand bonded with 6.5 per cent fire clay and 2 per cent western bentonite. The calcined clay is a sand-like calcined fire clay bonded with monoammonium phosphate and magnesium oxide. This mold material was baked at 450°F and at 1600°F. It will be observed that the calcined clay baked at 1600°F produced the highest tensile properties, the natural green sand second; whereas, the calcined clay or the synthetic sand baked at 450°F produced very low tensile properties and a fairly high degree of unsoundness.

As shown by the data in Table XII, a very large amount of pinholing occurs in the castings poured into the calcined clay baked at 450°F. These pinholes indicate that a very large amount of gas was absorbed by the melt from the mold material. This is readily accounted for by the reaction:

$$2NH_4MgPO_4 \cdot 6H_2O + \text{heat} \rightarrow Mg_2P_2O_7 + 2NH_3 + 7H_2O$$

Both ammonia and moisture are given off by the bond in this material when it is subjected to a high temperature. This reaction was not complete in the molds baked at 450° F so that both moisture and ammonia were evolved when the melt was poured into the mold. The ammonia is a prolific source of hydrogen since it breaks down to form atomic hydrogen. The moisture is also a source of atomic hydrogen as well as of atomic oxygen. Some of the data in Table XII are graphically represented by Fig. 19. The tensile properties vary gradually with pouring temperature when the metal is poured into the mold baked at 1600°F. On the other hand, the natural green sand produces erratic results which are fairly typical for this mold material.

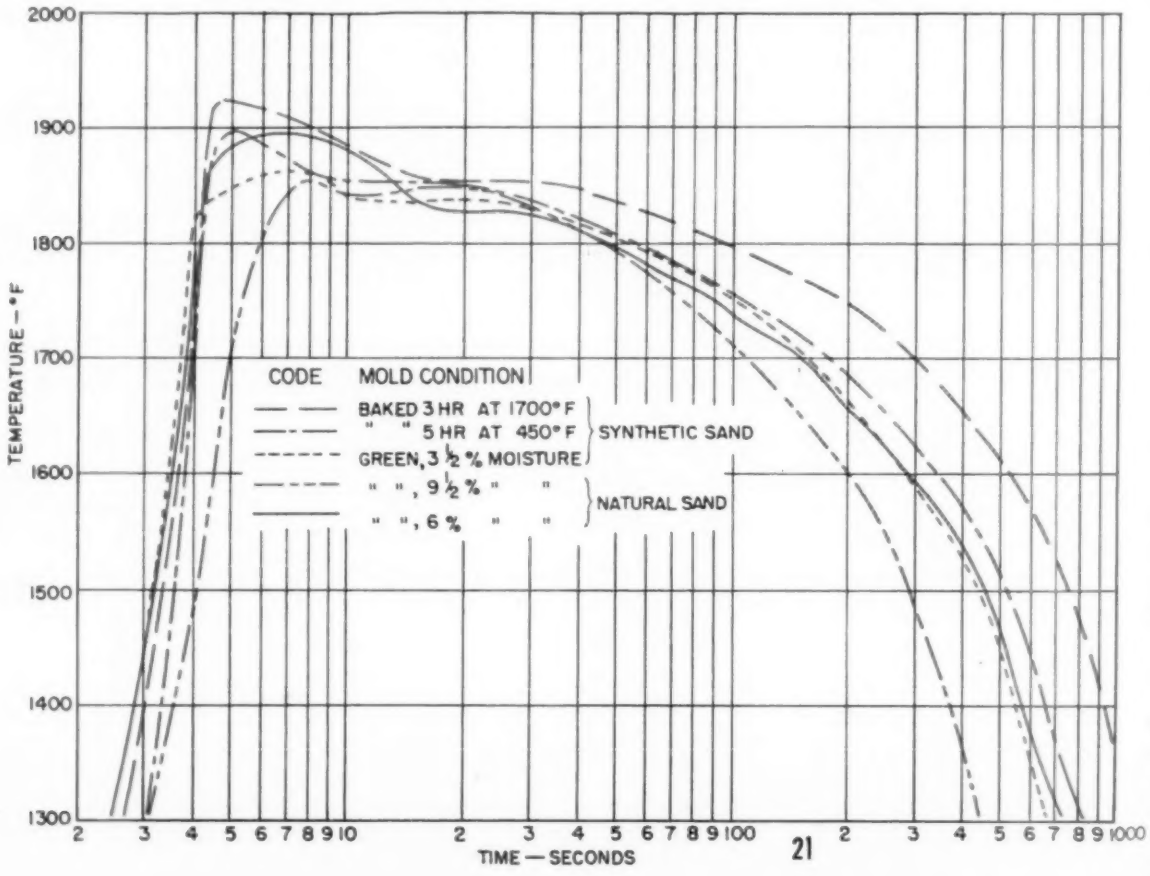


Fig. 21—Effect of various mold materials on cooling curves of 85-5-5-5 alloy at web section of ⅝-in. web Webbert bar poured at 2150° F. Heat—A 1093

All of the foregoing data provide ample evidence that the highest degree of soundness is obtained in castings poured into a mold which has previously been baked at a high temperature near 1600 or 1700°F. The next highest density is obtained in castings poured in the synthetic green sand, and the third highest density is obtained in natural green sand. The lowest densities are obtained in the synthetic sand molds baked at 450°F.

Both Lepp[52] and Pell-Walpole[18] report the higher tensile properties are obtained in a green sand than are obtained in the same mold material baked at 450°F. The data in Tables X, XI, and XII indicate that slightly higher properties and substantially higher densities are obtained in test bars cast in synthetic green sand than are obtained in the same mold material baked at 450°F. Lepp and Pell-Walpole also indicated that the higher properties obtained with the green sand were caused by the moisture in the sand which produced some chill effect. After baking at 450° F, the chemically combined water is still present and is, therefore, a source of gas, but the bulk water is absent, resulting in less chill and lower properties.

The cause of the inferior properties obtained in 85-5-5-5 alloy castings poured in the synthetic sand molds was the subject of considerable investigation. In line with the views expressed by Lepp and Pell-Walpole, a number of cooling curves were made by a very careful technique in order to demonstrate clearly, if possible, that the different results were caused by different cooling rates. The thermocouple bead was inserted in the web section of the Horizontal ⅝-in. web Webbert test bar mold, and cooling curves were automatically recorded on a potentiometer. Castings were poured precisely at 2150°F and the time-temperature relationship obtained for the various mold materials. Representative cooling curves for the various mold materials are represented by Figs. 20 and 21. While it was initially thought that the differences in cooling rate would account for the differences (*Please turn to page* 156)

TABLE XI—Comparison of Natural Green Sand With Various Other Mold Materials. Horizontal ⅝-in. Web-Webbert Test Bar*

Heat No.	Mold Material**	Pouring Temp., °F	No. of Bars	Tensile Strength, psi	Elongation in 2 in., Per Cent	Fracture Rating Code	Fracture Rating Description	Density***
A-1162D	Natural green sand, 6.2% H_2O, AFA permeability 40	2160	2	34,150	27.9	2B 2A	Moderately sound Unsound (micro-porosity)	8.71 8.76
A-1162E	Synthetic green sand	2150	2	26,650	12.0	2B to 2C	Fairly sound	8.75
A-1163F	Natural green sand, 6.2% H_2O AFA permeability 40	2160	2	36,300	40.9	2B	Unsound (micro-porosity)	8.82
A-1163G	Synthetic green sand	2150	2	31,950	19.3		Moderately sound	8.77
A-1298H	Natural green sand	2130	2	36,600	39.3	2B	Centerline shrinkage	8.75
A-1298E	Synthetic green sand	2150	2	29,300	15.8	2BS	Moderately sound	8.83
A-1173H	Natural green sand	2140	2	37,100	39.0	2B	Fairly sound	8.91
A-1173E	Synthetic sand baked 1700° F	2150	2	37,900	47.4	2C	Moderately sound	8.74
A-1192I	Natural green sand	2130	2	36,450	38.1	2B	Moderately sound	8.65
A-1192E	Synthetic sand, baked 450° F	2150	2	36,300	37.6	2B	Fairly sound	8.72
A-1253I	Natural green sand	2125	2	36,200	36.9	2B to 2C	Moderately sound	8.70
A-1253E	Synthetic sand, baked 450° F	2150	2	36,650	36.0	2B	Fairly sound	8.77
A-1193H	Natural green sand	2145	2	36,150	47.4	2C	Moderately sound	8.76
A-1193G	Synthetic sand, baked 450° F	2150	2	37,100	36.2	2B to 2C		

* Melts prepared in a silica-lined high-frequency induction furnace, using 50 per cent secondary ingot and 50 per cent foundry scrap; ¼ per cent zinc, and 2 ounces of 15 per cent phosphor copper were added to the ladle during the transfer.

** Natural sand is a Tennessee sand containing 6 per cent moisture and having an AFA permeability of 40. The synthetic sand consisted of clean silica sand bonded with 6.5 per cent fire clay and 2 per cent western bentonite, and 5 per cent water, and had an AFA green permeability of 88.

*** Measured on ½ of bar after fracture and, therefore, includes the grip end as well as the test section. Data not shown here indicate that the density is about 0.03 higher when it is measured before fracturing the bar.

TABLE XII—Effect of Mold Materials on the Properties and Density of 85-5-5-5 Alloy Poured into the Horizontal ⅝-in. Web-Webbert Test Bar*

Heat No.	Mold Material**	Pouring Temp., °F	No. of Bars	Tensile Strength, psi	Elongation in 2 in., Per Cent	Fracture Rating Code	Fracture Rating Description	Density***
A-3166A	Calcined clay, baked 1600° F	2305	4	38,700	45.6	1	Sound, fine gray	8.88
B	Calcined clay, baked 450° F	2295	4	22,450	16.7	2A	Very unsound (pinholes)	7.68
C	Synthetic green sand	2285	2	23,900	8.7	2A	Very unsound (micro-porosity)	8.67
D	Natural green sand	2275	2	35,500	35.8	2B	Moderately sound	8.58
F	Calcined clay, baked 1600° F	2175	4	38,700	47.4	1	Sound	8.87
G	Calcined clay, baked 450° F	2165	4	28,600	21.3	2A	Unsound (pinholes)	8.03
H	Synthetic green sand	2155	2	36,200	33.6	2C+	Fairly sound	8.36
I	Natural green sand	2145	2	37,400	42.0	2C+	Fairly sound	8.80
A-3416A	Natural green sand	2335	1	34,200	36.8	2A	Unsound (microporosity)	8.51
B	Calcined clay, baked 1600° F	2330	4	37,800	43.8	2C	Fairly sound	8.88
C	Natural green sand	2250	2	36,400	43.6	2C−	Fairly sound	8.71
D	Calcined clay, baked 1600° F	2245	4	37,900	47.6	1− to 2C+	Sound	8.87
E	Natural green sand	2150	2	36,300	35.3	2C	Fairly sound	8.79
F	Calcined clay, baked 1600° F	2140	3	38,300	48.8	1− to 2C	Sound	8.88
G	Natural green sand	2030	2	38,800	36.0	1−	Sound	8.88
H	Calcined clay, baked 1600° F	1995	3	39,900	42.1	1−	Sound	8.89

* Melts prepared in a silica-lined high-frequency induction furnace, using 50 per cent secondary ingot and 50 per cent foundry scrap; ¼ per cent zinc, and 2 ounces of 15 per cent phosphor copper were added to the ladle during the transfer.

** Natural sand is a Tennessee sand containing 6 per cent moisture and having an AFA permeability of 40. Synthetic sand consisted of clean sand with 6½ per cent fire clay, 2 per cent western bentonite, and 5 per cent moisture and has an AFA permeability of 88. Calcined clay was bonded with 6 per cent monoammonium phosphate, 3 per cent magnesium oxide, and 7½ per cent water.

*** See footnote Table XI.

Experience Can Point Way to Better

By CLYDE L. FREAR
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DURING the war emergency the author had the opportunity of examining a large number of castings of all varieties and sizes, and of following many of these castings from their inception on the drawing board through the manufacturing processes. Considerable study was devoted to methods of inspection, repair of defects, and correction of foundry technique. Frequently delivery of necessary fighting ships was in danger of being seriously delayed by the nonarrival of some small casting which, though it might have been considered as very minor in nature, prevented the completion of some important and necessary piece of equipment. In most cases the shipbuilder was not at fault. Neither could the blame be laid entirely on the subcontractor supplying the equipment.

In many cases the delay could be traced directly to some casting which a foundry had agreed to supply. The order had been taken in good faith, with the foundryman believing that the casting could be made without any particular difficulty. However, because some unforseen trouble developed, the casting was rejected, as also were the replacement castings. The difficulties may have been due to overlooked oddities in design, to the necessity of using inferior grades of metal, to untrained foundry personnel, or even to unexpected problems resulting from an inspection which was more strict than was absolutely necessary in the particular case.

By looking back over the difficulties encountered during the period, and in the more distant past, and by studying these mistakes in the light of recent findings and information which is freely available in numerous publications, it may be possible to find the answer to many problems, thus avoiding to a certain extent a repetition of past errors.

At the beginning of this discussion, the author desires to congratulate foundrymen who, though beset with problems probably greater than in any other industry, increased production to an extent which previously would have been considered impossible with the plant and

Castings

equipment available. Such a production increase would have caused many difficulties under ordinary circumstances. The problem was accentuated greatly during the war, due in part to the fact that many of the better workmen were being taken by the armed forces, and it was almost impossible to train new personnel in time to meet production schedules. Considering the problems of personnel and materials procurenment it is surprising that the foundry industry was able to accomplish so much in the production of castings.

What are some of the lessons learned in war production that may be applied to present day problems? Perhaps the best way to approach this question is to consider some of the problems that developed. In undertaking this discussion, the author is not offering a general criticism of the foundry industry, but rather is revealing what occured in a few plants, and in some of which the difficulties were limited to one or two designs out of an otherwise satisfactory production.

It must be admitted that the foundryman probably encounters more variables in the production of castings than are met in any other manufacturing industry. Bearing this in mind, it is to be expected that the production of castings is beset with many difficulties, and we should not be too surprised when castings contain defects or are not entirely satisfactory for the purpose for which they were intended. If these defective castings remained in the foundry, little harm would result, beyond the loss to the particular foundry making them. This, unfortunately, has not always been the case. Castings which may have had an excellent appearance were shipped, and it was not until they were machined and frequently actually fabricated into the finished product that the defects were discovered. This resulted in a loss to the foundryman to whom they were returned for credit and to whom they were of no use except as scrap. Usually it also resulted in a greater loss to the purchaser who expended considerable time, effort and money in machining, fabricating, and testing an article which could not be used.

Here is an example of costs resulting from defective castings. The author was privileged to be present at a conference between representatives of one manufacturer and of the foundry supplying the castings. Over a period of two years this manufacturer had purchased a large number of the castings in question, approximately 25 per cent of which had been returned to the foundry as scrap because of leakage. An analysis of costs showed that the scrapped castings had cost the foundry $33,000 for the two years. On the other hand, these same castings had cost the manufacturer $254,000 in machining, assembly, testing, and disassembly. In this case, if the buyer could have been assured that no scrapped castings would result, he could have paid approximately eight times as much for the castings and still come out even, considering only the cost of the material and labor, and leaving out all costs due to lost production.

A thorough study of these castings was made by the foundry and representatives of the manufacturer. It was found that a considerable amount of the leakage was the result of insufficient metal at the bottom of bosses which were drilled and tapped. The purchaser co-operated with the foundry by making such changes as were considered necessary. The patterns were changed to make these alterations and to provide feeding in all sections. One of the major changes was to reverse the position of the pattern in the mold. Then attention was directed to the melting procedure by lowering the melting and pouring temperatures and correcting the deoxidation practice. As a result of this study, which should have been made before production was ever started, the scrap loss on these castings was almost entirely eliminated, thus reducing considerably the production cost to the foundry.

Some Designs Are Not Castable

It must be remembered that most manufacturers are going to buy materials which they can obtain at the lowest price consistent with satisfactory quality, often willingly paying higher costs for such quality. If they cannot get suitable castings, then they are going to find something else which will be more satisfactory.

The statement has been made that 90 per cent of casting designs can be cast if sufficient care is taken in all the foundry operations, and that probably 90 per cent of these castable designs could be made quicker, easier and more economically if the design were changed. Often the desirable changes are minor in nature, such as providing improved flow of metal in the mold, or designing a slightly different position for risers or gates. In some cases, however, a complete redesign of the part may be necessary. As sometimes happens, such redesign may reduce the amount of machining and other fabrication on the part of the purchaser. On the other hand, there are parts which never should have been designed as castings.

What is the foundryman to do about those designs which cannot be cast, but which can be improved by redesigning? Probably the simplest answer would be for the foundry to refuse to accept an order for a casting which it was felt could not be made with the required soundness. Such a course will avoid any loss, but by the same token will provide no profit. The buyer, finding that he cannot get the part made as a casting, will then go over to some other fabricating method.

A better procedure on the part of the foundry when such a design is presented would be to go back to the prospective purchaser and tell him exactly why the part as it is designed cannot be made economically with the necessary soundness, and request such changes as might be necessary. Most engineers are willing to give due consideration to such suggestions and to incorporate them into a new design. In the case of a "die-hard" who refuses to consider any changes, it would probably be best to refuse to accept the order.

In this connection there (*Please turn to page* 206)

X-ray Inspection Promotes CASTING QUALITY

By E. H. GRIMM
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Auto Specialties Mfg. Co.
St. Joseph, Mich.

FEW industries illustrate the value of x-ray in quality control as well as does the foundry business. Here, the many variables throughout the process of production make it important to have one "supreme court" before which each slight change in method can be tested and retested.

X-raying pilot lots, and re-examining periodically thereafter, provide a close and continuous check on production quality, and prevent faulty castings from ever leaving the foundry. The resultant reduction in rejects produces both an immediate dollars-and-cents saving and a long-range gain in customer good-will. In addition, x-raying castings before they are machined saves countless hours of machining time.

Although destructive testing is still employed to a limited degree, even in plants stressing x-ray, it becomes chiefly a corroborative measure and a means of studying more precisely the exact nature and extent of a defect. X-ray, being low cost per examination, makes it economically possible to keep a multitude of variables constantly under the control of experienced personnel.

Auto Specialties Mfg. Co., St. Joseph, Mich., specializes in products for the auto industry, chiefly cast steel crankshaft and malleable iron castings; it also manufactures hydraulic and mechanical jacks. The firm is of medium size, yet has some of the most modern foundry equipment in the country. Conveyors assist in performing the principal operations.

Originally users of a 220,000-volt x-ray unit, the company a little over a year ago installed a 1,000,000-volt x-ray machine in a special concrete building. Practically all radiography of both large and small objects now is done with the larger unit. It has been found that the greater speed and the elimination of copper-shot blocking, possible with the high-voltage machine, make it preferable in many instances to the smaller unit.

Experience shows that—contrary to commonly-held opinion—one does not have to be a producer of heavy castings to use high voltage x-ray economically. The exposure time economies of higher-voltage are equally

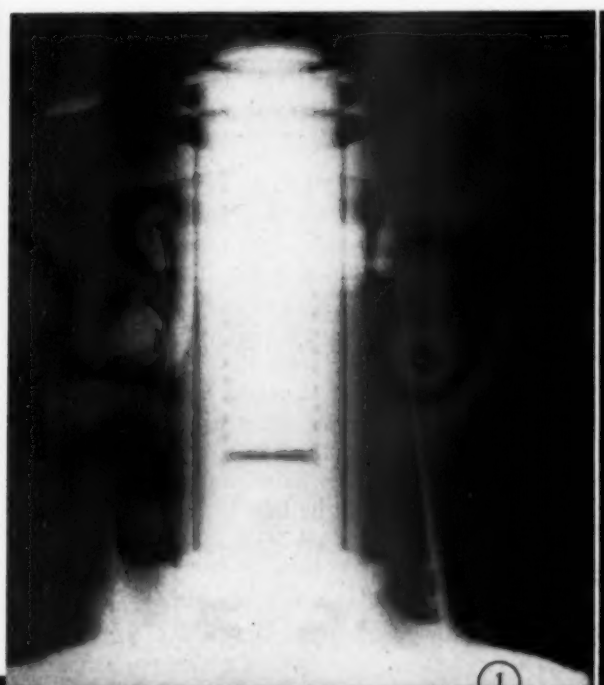
Fig. 1—Wide latitude of high-voltage x-ray to sections of varying thickness is shown by this radiograph of assembled jack

Fig. 2—*(A)* Radiograph of motor housing before reduction in weight of sprue and runner. *(B)* Housing sprue and runner after weight reduction of 5½ lb

Fig. 3—*(A)* Portion of crankshaft radiographed to show shrinkage caused by location of gate at bearing. *(B)* Same crankshaft showing elimination of shrinkage after gate shifted to arm

Fig. 4—Casting crankshafts vertically in cores

Fig. 5—The author shown aligning beam of million-volt x-ray unit before radiographing a motor housing. All photos courtesy General Electric X-Ray Corp.



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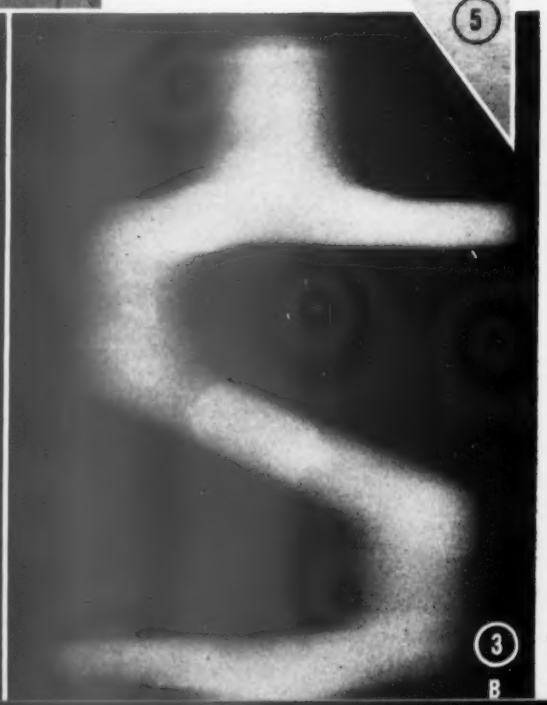

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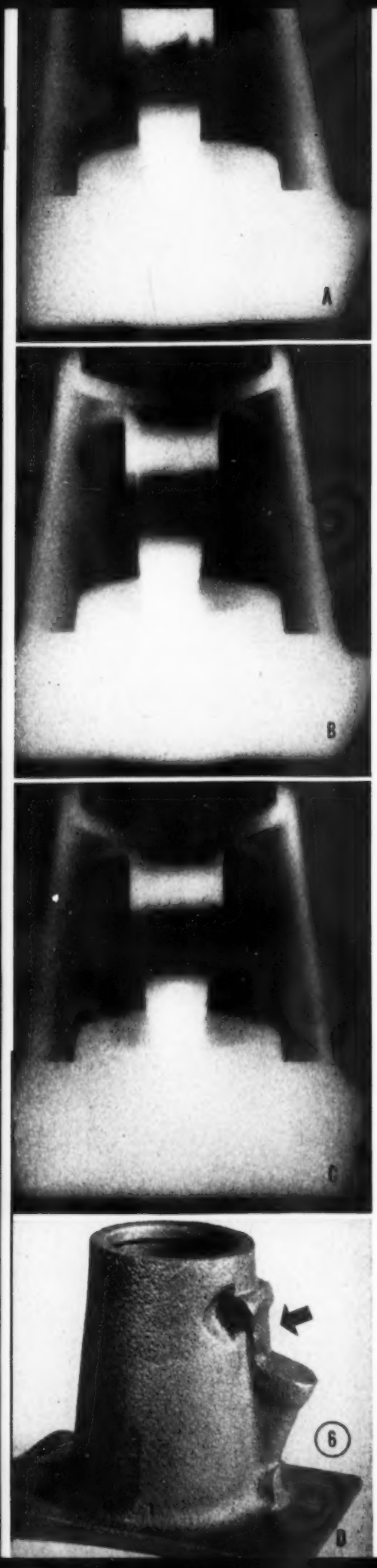

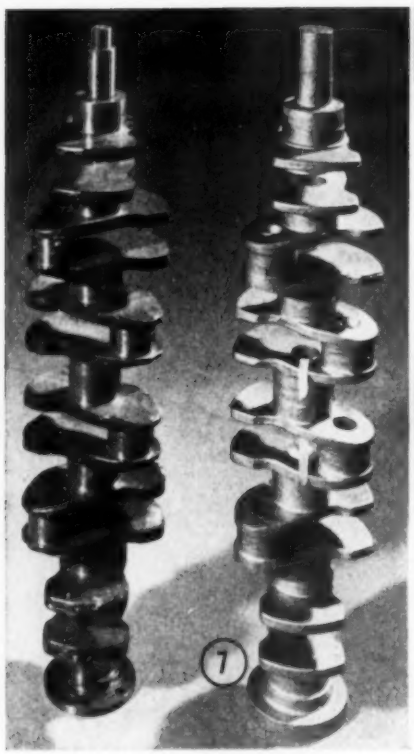

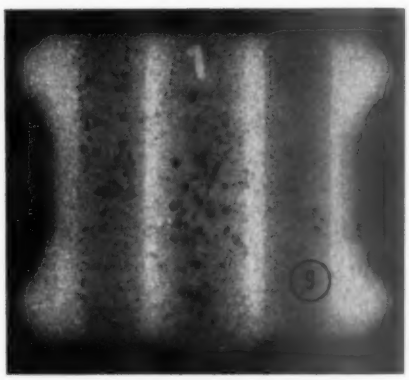

Fig. 6—Radiograph of jack base in which shrinkage occurred in web below gate because of restriction in flow between two protruding parts. *(B)* Same jack base showing result of attempt to eliminate shrinkage by welding. *(C)* Shrinkage eliminated in jack base by enlarging web area. *(D)* View of jack base. Arrow points to web

Fig. 7—Radiographically-controlled casting procedures permitted development of this design, with partial hollows in bearings and complete hollows through center of crankshaft

Fig. 8—How casting permitted hollowing out bearing areas on certain types of crankshafts, with great saving in weight

Fig. 9—Radiograph showing pinholes in casting caused by insufficient deoxidation of the melt

available to the producer of small castings, such as motor housings, automotive crankshafts and the like. Also because of its higher intensity, the more powerful x-ray equipment can be backed further away from the film, thus permitting the radiography of more products with one exposure. Radiography of crankshafts, for example, is done at a target-to-film distance of 10 ft which permits inclution of six or more crankshafts at one time.

Because of its shorter wavelength, high-voltage x-ray can encompass a greater range of thicknesses in a single radiograph, thus making it ideal for such irregular shapes as crankshafts and jacks, regardless of size.

Case Histories—The company's radiographic files contain many outstanding instances in which x-ray findings played a vital role in increasing yield, modifying production processes, and even in changing the design of a product.

The case of a sprue and runner in casting a motor housing (Fig. 2) is typical. As a result of radiographic study, it was found that this sprue and runner could be materially shortened—by 5½ lb, to be exact—thus increasing the yield of actual casting from 55 to 59 per cent of the melt.

Prior to the redesign, the weight of the metal in the mold was 90 lb, of which 40 lb or 45 per cent was sprue and runner. Afterward, total weight was cut to 84½ lb of which sprue and runner accounted for 34½ lb.

Another leading example (Fig. 3) was the (*Please turn to page* 130)

Sand Control

By G. W. ANSELMAN
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Chicago

TO OBTAIN sand control in either the jobbing or production foundry, it is necessary to start with the selection of the sand according to its grain size and not to any AFA grain fineness number. In selecting this sand at least 60 per cent, and preferably 70 per cent, should be contained on three consecutive screens. The three screens to be selected depend upon the cross section of the casting to be made. If the cross section is 1 in. and under, with a good concentrated screen analysis, the sand should lay primarily on the 100, 140 and 200 mesh screens. If it is strictly a mechanical shop with mullers in the preparation unit and all mechanical ramming, it is desirable to have as little on the 270 and pan as possible. In jobbing shop practice, where there are a number of loose patterns used and hand rammed, then it is desirable to have approximately 10 per cent on the latter two screens. This allows for softer ramming without metal penetration. Where stoveplate is made and merely stepping off a shallow cope, it has been my experience that up to 15 per cent on these two screens is satisfactory.

Selection of the core sand must match the grain size of the molding sand in order to prevent spreading of the screen analysis when the two are combined and mixed in the shakeout. It would destroy the finish if the core sand was coarser, or lower the permeability if it had a wide grain distribution or was on the finer screens. However, even a coarser sand will lower the permeability when less than a total of 20 per cent is added.

There has been a great deal of talk about the accumulation of fines in foundry sand. After running a number of screen analyses in various shops throughout the country, we always find less actual fines in the sand heap than is actually in the new sand. By fines we mean material that will remain on the 200, 270 and pan. The shop without any dust collecting system at the shakeout will get rid of these fines through the heat convection currents that will carry them up and distribute them around the foundry as fine beam dust.

In about 95 per cent of all the foundries we have checked, the reason for the lowering of the permeability in the heap is due to spreading the screen analysis. This goes back to a poor selection of molding sand or a poor combination of molding sand and core sand. In selecting sand for medium work, with cross sections from 1 to 3 in., sand that is on the 50, 70 and 100 mesh is amply coarse and should give permeability of from 75 to 100. Again it is necessary to select a core sand with the same distribution as the molding sand. For real heavy jobbing work and pit work, a sand that is maintained on the 40, 50 and 70 is coarse enough. If the grain is coarser than this with too much, say 30-mesh material, there is apt to be too much metal penetration, which is generally confused with burned-on or fused sand. Grain size control, or the selection according to grain size, seems to be the foundation upon which all sand control is built. That is why we must stress this in the selection of molding sand in order to obtain the ultimate of control in the shop.

The next thing involved in molding sand is the type of clay selected, whether it be a natural sand or a synthetic sand. Generally speaking, the most durable clays are not always the most desirable, especially where finish is an important or prime factor on the casting being made. The more durable clays are rougher and harder and do not lend themselves to flowing and packing around the intricate parts of the pattern as well as some of the softer clays, which are less durable. Foundrymen generally are familiar with the smoothness of the sand known as Albany. This sand, produced around Albany, N. Y., and the Hudson Valley, has a low fusion point, but will produce a very fine ornamental iron casting or fine work that is poured at low temperatures. The sand and grain, however, are both completely fused at around 2600°F, depending upon the amount of clay and grain involved.

This sand gained its reputation in early days in the stoveplate foundries where the iron was poured at approximately 2550 to 2600°F, and was fluid at this temperature due to the high phosphorus content in the metal. However, today in the modern stove shop where we are pouring at temperatures around 2800°F, this sand is not satisfactory, first because there is a fusion of the sand at this temperature and secondly, because it has too much pan material to withstand the hard ramming under mechanical methods, such as jolt squeeze or slinger work.

Today a more open sand is used with a high silica base grain to withstand the temperature and a clay that is soft, not too durable, but one that will give the desired properties for a hard rammed sand. This softening, or partial fusion, at low temperatures in the Albany sand is what gave it its ability to withstand expansion troubles or rat tails.

With present practice a clay must be selected that is soft, has good expanding qualities that will offset the expansion through the range of the higher pouring temperatures. If a very durable clay is chosen that will compare with the kaolinite clay or fire clay, it is true that the clay would be very durable, but the finish would not be satisfactory due to the lack of flowability, or softness of the clay, or its ability to flow under the rammer or squeeze head.

In the extremes in synthetic sand, there is the kaolinite clay as the most durable and bentonite as the least durable. Consequently, we must (*Please turn to page* 164)

Questions and Answers

Porosity Due To Lack of Feed

Q.—We are sending for your examination a small gray iron casting which forms a pressure head on a machine. You will note a porous area in the center of the heavy lug extending from the side, and we would like to know the cause, and how it can be corrected.

A.—The porous area at the center of the heaviest section of the casting is a shrink due to lack of feed, and the remedy is to insure that an adequate supply of liquid metal is available until the casting has solidified completely. Since no information is given on the method of molding, we can only guess on that point. It appears to us that the body of sand forming the cavity in the casting whether green or a core, is hung from the cope, and that a flat thin gate with a small, side-attached riser is used.

We believe that it would be much better to turn the job over with the same type of parting, and permit the pattern to leave its own green sand core. Gating should be into the end of the heavy lug, and the gate entrance should be of such size that it will not freeze before the casting. The same thing can be done without any change in molding procedure. If you are using a shallow cope, it is suggested that its height be increased to provide a higher ferrostatic head.

Information on Making Cores

Q.—Some of our work is associated with the making of cores and we are anxious to obtain all the information we can on the proper mixing and forming of cores for gray iron and brass castings.

A.—Without information on the section thickness of the casting in relation to the core and other pertinent data, it is not possible to give a definite reply to your inquiry. A variety of core binders are available from manufacturers advertising in THE FOUNDRY, and they will be glad to supply information on the procedures to obtain the most satisfactory results. We also suggest that you consult your present supplier if you are having any difficulty.

Briefly, it may be pointed out that linseed-base core oils are being used successfully in production of cores for both ferrous and nonferrous metals and alloys. Proportions of sand and oil always should be determined by weight, and may range from as low as 40 lb sand to 1 lb oil to as high as 100 lb sand to 1 lb oil with an average around 70 to 80 lb sand to 1 lb oil. Since core oil provides no green strength, it is necessary to add either a clay-containing bank sand or a cereal binder for that purpose.

Sand and binder should be mixed thoroughly to distribute the binder uniformly on each sand grain. Water may be added before or after the addition of the binder, and may vary from 3 to 5 per cent. Cores are baked at 450 to 500° F until they are thoroughly dry. Time required will depend upon core thickness, moisture content, fineness of sand, etc.

Want To Color Aluminum Alloy

Q.—What information can you give us on coloring aluminum while it is being melted prior to pouring into molds? Is such material on the market, and if so where can we purchase it?

A.—So far a method of coloring aluminum by the addition of some substance to it while in the molten condition, has not come to our attention. Reports indicate that the Russians have developed a method for coloring stainless steel in that manner, but no information on how it is accomplished. Present methods of coloring aluminum involve the formation of an oxide coat on the surface which will absorb a dye or pigment color. After coloring the surface is sealed by boiling in hot water. Colors applied in that manner are claimed to have good wearing power.

Reducing Pig Iron in Charge

Q.—Due to the shortage of pig iron we must reduce the pig in our mixture from 30 to 15 per cent, and we would like to know how to make adjustments to provide the proper iron for our castings. They are light and about 50 per cent are burner castings for gas and oil heating equipment and gas stoves. They weigh from ½ to 8 or 10 lb and must be machinable. We are melting about 5 tons per day using 1000-lb charges.

A.—Decrease in the amount of pig iron in your charges and substitution of a like amount of gray iron scrap presumably will result in a lower silicon content in the iron at the cupola spout. Hence, you will have to make additions of silicon-bearing material, such as ferrosilicon or silvery pig iron, to the charge or in the ladle to bring the silicon up to the proper range for the particular section thickness of the castings. Since we do not know the compositions of your present cupola iron or pig iron and the kind of scrap being used, no definite recommendations can be made.

However, we can indicate the procedure by assuming that your pig iron contains 3.50 per cent Si. At present use of 300 lb of that pig and 700 lb of gray iron scrap, with an average 2 per cent Si, will give a total silicon content in the mix of 24.50 lb. Reducing the pig to 150 lb and increasing the scrap to 850 lb gives a total silicon content of 22.25 lb. Hence 2.25 lb of silicon will have to be added to each 1000 lb of iron. That quantity may be added to the charge by use of ferrosilicon briquets, silvery pig iron or lump ferrosilicon. In the case of ferrosilicon briquets the addition of 2½ small size (containing 1 lb Si each) will give a final silicon of 24.75 lb in the charge.

With silvery pig containing 9 per cent Si the mixture should be comprised of 100 lb of the 3.50 per cent pig iron, 50 lb silvery pig and 850 lb scrap which will give 25 lb Si in the charge. With lump ferrosilicon containing 80

per cent Si the theoretical addition would be 2.8 lb, but since a somewhat higher oxidation loss is to be expected, it may be advisable to add 3.5 lb to the charge, giving a final silicon of 25.05 lb in the charge. Ferrosilicon also may be added in the ladle, and in that case it should be ground to 1/8-in. mesh and under. Since recovery will be higher than in cupola addition, about 3 lb should serve.

Higher Sprue Stops Shrinkage

Q.—For your attention we are forwarding a small gray iron pump body casting molded in a 14 x 14-in. snap flask, 4-in. drag and 4 1/2-in. cope. The green sand core is air dried. Openings in the upper and lower lugs are formed by small tubes. We never have any trouble with the lug in the drag, but the lug in the cope kicks or blows.

A.—The defect in the casting is not a kick or blow caused by gas or steam. It is caused by a universal natural law that applies to all liquids. They find their own level. In your case, after the mold is filled the metal drains back into the sprue, and that action draws some of the metal down from the high lug, leaving just the thin shell of metal that has solidified in contact with the sand. The casting extends 3 in. into a cope 4½ in. deep. Even where the sprue is filled to the limit, that only gives a head of 1 1/2 in. above the highest point on the casting. However, the sprue is not always filled to the top.

Every pourer develops an instinctive desire to *cut 'er short*, to prevent straining the casting or to avoid splashing metal over the side of the mold. The combination of items fills the mold quickly. The pourer walks on to the next mold. The metal in the first mold settles down and a certain amount drains out of the high lug. Obviously the remedy in this particular case is to raise the sprue approximately 2 in. The entire body of sand in the cope can be extended 2 in. by placing an upset or frame on the cope flask. However, a simpler method is to place a small dry sand pouring cup over the sprue as at present existing. Instruct the pourer to fill the mold slowly, touch 'er up at the end of the pour and, above all, fill the sprue to the top.

Removing Sulphur in the Iron

Q.—We are operating a foundry in Italy and at present our coke has a sulphur content of 2.5 per cent which adversely affects the iron melted in the cupola. Can you suggest some method of eliminating or alleviating the trouble?

A.—Sulphur content of your cupola iron can be reduced appreciably by use of fused soda ash (sodium carbonate) in the form of an after or ladle treatment. In this country many foundries conduct the operation in a large mixing ladle permanently located in front of the cupola. The ladle is the teapot spout type; that is, it contains a partition which allows metal to be drawn only from the bottom of the ladle during pouring. Molten metal from the cupola spout flows into the ladle which is covered with a thick layer of molten soda ash. From time to time the ladle is tipped back, part of the soda ash skimmed off and fresh material added. Quantity of soda ash varies with the amount of sulphur to be removed. In your case you may need 30 to 40 lb per ton.

For best results it is necessary that the iron be free from siliceous slag generated during cupola melting, since the soda ash preferentially will react with silica with consequent reduction in desulphurization. You also can remove some of the sulphur by adding 4 to 6 lb of soda ash per ton of iron in the cupola with the regular limestone flux. However, the highest reduction in sulphur is secured with iron free from slag.

Another possibility for sulphur removal is use of a basic-lined cupola, as tried out in Great Britain. Lining is composed of stabilized dolomite prepared by adding serpentine to dolomote, grinding and firing. Limestone to the extent of 7 per cent of the metal charge plus 1 per cent fluorspar is used as the flux. Further details of the practice are given in the First Report of the Melting Furnaces Subcommittee of the Institute of British Foundrymen (1944), and in an article "Basic Cupola Process for Desulphurization" by E. S. Renshaw which appeared in the June 24, 1943, issue of *Foundry Trade Journal*.

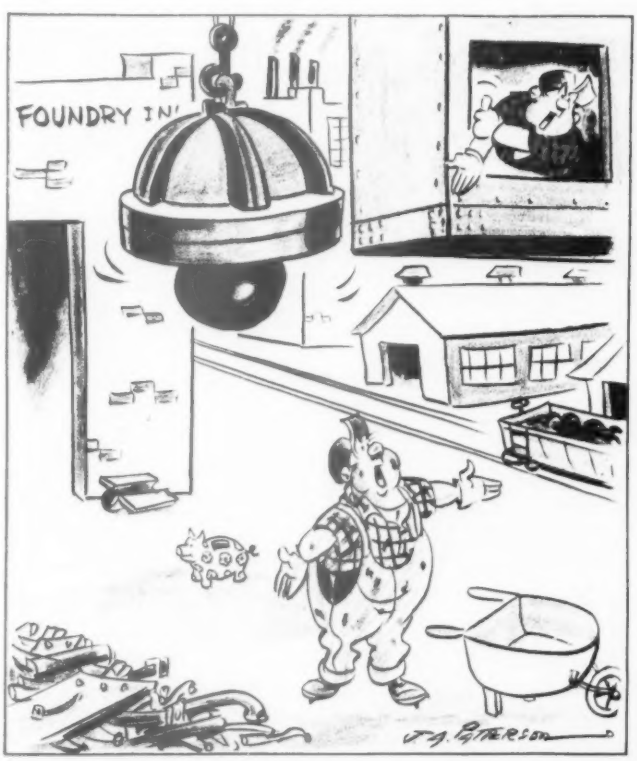
To Blow Steel in Small Lots

Q.—We shall appreciate any information on melting steel in 100 to 200 lb batches to pour light experimental castings. Expense must be held to a minimum. Would it be feasible to build a cupola and side blow converter? Do you know of any instances where a miniature converter has been used successfully? We realize that an electric furnace would be the ideal type of melting medium, but in our case the cost is too high. If the plan is feasible can you supply the necessary data, or refer us to a suitable source for information that would enable us to construct a small converter?

A.—Although we regret to throw a dash of cold water on any ambitious program we are afraid that in this instance the answer is no to every outlined item. Even if you succeeded in getting plans and specifications and

GANGWAY!

By J. A. PATTERSON



"I don't give a hoot if it is just until Saturday—I ain't breakin' your kid's piggy bank for you."

succeeded in blowing a heat now and again the total cost of your castings would be out of all reason. With intermittent operation turning out a casting or a few castings occasionally, you could not live long enough to absorb the difference in cost between castings made with your installation, and castings bought from any of the steel foundries in your general vicinity. As perfectly neutral and unbiased observers, our suggestion would be that you continue to apply yourself to your specialty of inventing and developing and leave the manufacture of castings to the specialists in steel foundry practice.

Art Casting Needs Experience

Q.—Please give us complete and detailed information on having a pattern made from a hard clay model of a book end about 7 in. high.

A.—We are afraid you grievously underestimate all that is involved in your apparently simple request for information leading to (presumably) the production of an artistic bronze replica of an existing clay model. So many technical features present themselves, that any written description would not be of any use unless you had general foundry background and experience. Our considered suggestion is that you turn the job over to a local pattern shop or nonferrous foundry and let them wrestle with it.

Many methods are available for the production of complicated bronze castings. The *cire perdu* or lost wax process commends itself in many respects where only one casting is required. The method presents certain objectionable features where it is necessary to produce many duplicate castings. A wax reproduction of the original model has to be made for each casting and a plaster piece mold has to be prepared for the production of the wax reproduction. A considerable degree of technical skill and knowledge is required to make one of these plaster molds in many pieces. In a second method a flexible gelatin mold is employed for making the wax impressions. In a third method the wax image is copper plated electrically. Afterward the thin shell is filled with lead or other metal. In many instances rubber molds are employed as indicated in a description of making art bronze castings by W. W. Boone, presented in the Sept. 15, 1925, issue of THE FOUNDRY. Back issues of this are not available. Other articles on the same general subject have been published on many occasions.

Gives Data on a Small Cupola

Q.—We wish to build a 24-in. cupola for melting iron, and would appreciate information on tuyeres and location, and the volume and pressure of air.

A.—You do not mention whether you have a steel shell available or whether you intend to make one. Standard shell usually is 32 in. in diam., and lined with 4½-in. brick which given an inside diameter of 23 in. Hence, if you desire to have a 24-in. inside diam. you will need a 33-in. shell. Since there is only a difference of about 350 lb per hour between cupolas line to 23 and 24 in., it will be wiser to stick to the standard 32-in. shell lined to 23 in. with standard 4½-in. circle brick or rammed refractory.

Tuyere area of cupolas varies from one-fourth to one-sixth the cross-sectional area of the cupola at the tuyere location. One lined to 23 in. has an area of 415 sq in., and using one-fifth (the average of the previously noted values) as the ratio, the tuyere area will be 83 sq in. In a small cupola four tuyeres should be sufficient, and then each should be 3½ x 6 in. With 35-lb coke splits the air supply should be about 940 cu ft per minute at 12 oz pressure. Height of the tuyeres above the sand bottom will depend upon how much iron you want to carry in the well.

Position of the slaghole is the controlling feature in the sense that the iron level will have to be somewhat below that point, and the slaghole should be not less than 4 in. below the bottom of the tuyere level. As the well of the cupola is filled with coke, you can count on its holding only around 40 per cent of the calculated amount of iron, or about 42 lb iron per inch of height. Hence, if the slaghole is 10 in. above the bottom the well will hold 420 lb of iron or about a charge and a half of iron when melting at an 8 to 1 ratio. With the slaghole at 10 in. above the bottom, then the tuyeres will be 14 in. above the bottom.

Iron Castings Are Defective

Q.—We are forwarding for your inspection a small gray iron casting, typical of many which show shrinks, blows, internal shrinkage and draws. Metal is melted in a cupola lined to 36 in. diam. The coke bed extends 40 in. above the tuyeres. We use 85-lb coke splits between the 700-lb iron charges, with a 100-lb booster on the fourth charge. The iron is hot throughout the daily heat of 5600 lb, melted in 1 1/4 hr. The charge is made up of 250 lb pig iron, 50 lb rail steel, 200 lb shop returns, 200 lb purchased scrap. Pig iron analysis shows: Si 2.72; S 0.031; P 0.72; Mn 0.77. Typical casting analysis shows: TC 3.30 to 3.45; Si 1.98 to 2.08; Mn 0.39 to 0.47. We place a 30 lb limestone and 2 lb proprietary flux on the coke bed and 20 lb limestone and 1 lb proprietary flux on each coke split. Ladles and spout are perfectly dry. Unfortunately, we have no gages to check blast volume and pressure. Since our cupola practice conforms to the usual standards, we are at a loss to account for the defects in the castings.

A.—The defect in the casting submitted for examination and presumably similar defects in other castings are directly traceable to the sand in the mold, apparently abnormally high in clay content and therefore lacking in permeability. Additional evidence of the high clay content and resulting low refractoriness is shown by the thin fused film on the face of the casting. Lack of ready means of escape causes the metal in the mold to boil. Too many castings in a mold, too close together will cause the iron to boil in every mold. Some of the steam escapes through the metal and through the gate and through a riser, if a riser is attached to the casting. A certain amount remains trapped here and there in the casting to appear as a cavity or cavities after the metal has solidified. In some cases the boiling action interferes with the normal shrinkage and with the normal movement of the metal in certain areas to compensate for shrinkage. The result may not show as a direct cavity, but it will show as a spongy area and may show up as a crack. The obvious remedy is to use a more permeable sand from which the steam can escape rapidly. Your description of your cupola practice indicates that it is satisfactory except we wonder about the 100-lb booster charge of coke. Have you tried leaving it out? Perhaps the bed is too low.

AN AGE-HARDENABLE

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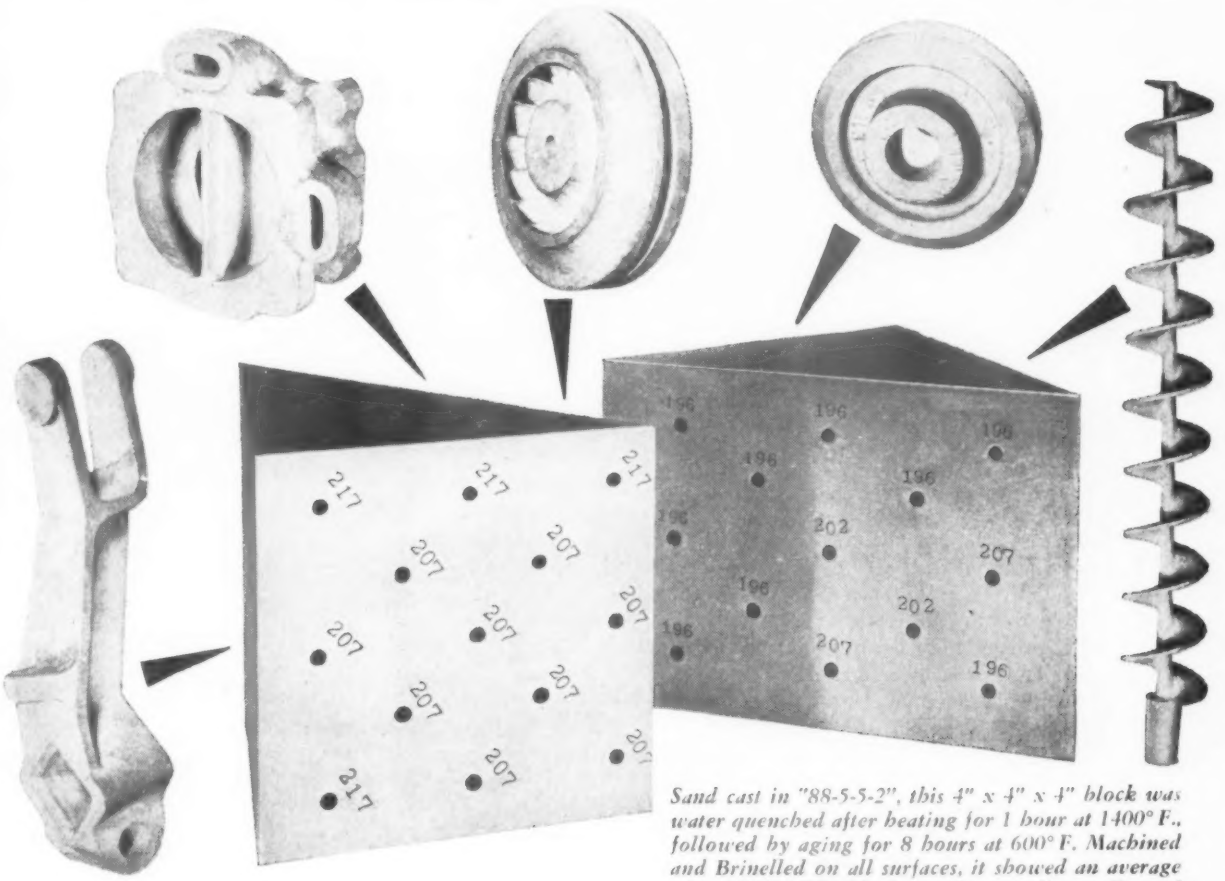

Sand cast in "88-5-5-2", this 4" x 4" x 4" block was water quenched after heating for 1 hour at 1400° F., followed by aging for 8 hours at 600° F. Machined and Brinelled on all surfaces, it showed an average of 209 BHN. The block was then cut diagonally, and both interior surfaces averaged 197 BHN.

Specify "88-5-5-2" (Copper-Tin-Nickel-Zinc) where you want corrosion-resistant bronze castings with extremely high mechanical properties.

This alloy in the "as-cast" condition serves the same purposes as "G" Bronze, but that's not the whole story.

The excellent physical properties of "88-5-5-2" may be immensely improved by heat treating . . . as exemplified by the block shown above.

The Nickel content provides the age-hardening response which increases both tensile and compressive strength, being particularly effective in raising the elastic properties. Nickel also increases fluidity in the casting mixture, thus affording a widened casting range that helps to minimize misruns and improves density and pressure-tightness.

This age-hardening Nickel-bronze meets wide demands. Philadelphia Bronze and Brass Corp., maker of the parts illustrated, produces "88-5-5-2" castings that range in size from ½" x 12" bars to parts weighing over 500 pounds.

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MEN of Industry

CHARLES E. NELSON, technical director of the Magnesium Division, Dow Chemical Co., Midland, Mich., has been selected to present the Charles Edgar Hoyt Annual Lecture at the 1948 convention of the American Foundrymen's Association in Philadelphia. He will speak on "The Control of Grain Size in Magnesium Castings." Active in many technical groups of the association, Mr. Nelson has been a member of the society's Aluminum and Magnesium Division executive committee since its organization. He is the present head of the design and stress analysis committee of the light metals group and a member of its research committee. Formerly chairman of the yield strength committee, Mr. Nelson has also been associated with the division's investigations on die, permanent mold, plaster and centrifugal casting, and shrinkage and porosity. A graduate of Alma (Mich.) College, he joined the Magnesium Division of Dow Chemical Co. at Midland in 1930, as a research metallurgist, became chief of the metallurgical staff in 1937, assistant director of metallurgical research in 1941 and was made technical director of the magnesium division last year.

♦ ♦ ♦

Frank E. Wartgow, who recently resigned as office manager and in charge of exhibits, American Foundrymen's Association, Chicago, has joined the sales group of the Foundry Equipment Division, Whiting Corp., Harvey, Ill. Mr. Wartgow, prior to his association with the AFA, was a supervising engineer with Hasbrouck Haynes Engineers, Chicago, and before that held supervisory positions at American Steel Foundries, Chicago, specializing in industrial and time study engineering.

♦ ♦ ♦

Rear Adm. William Granat, U. S. Navy (Retired) has joined Lester B. Knight & Associates Inc., Chicago. Adm. Granat was graduated from the Naval Academy and served in both World Wars. Following postgraduate work in metallurgy at Lehigh University, he spent 4 years at U. S. Naval Gun Factory, Washington, as head of its laboratories, his primary interest being centered in procedures, practices, and quality control of ferrous and nonferrous foundries. Years of experience in the Bureau of Ordnance and office of the Secretary of the Navy gave Adm. Granat a varied and broad experience through close contact with industry, in research and development, management engineering, maintenance, etc.

♦ ♦ ♦

Robert R. Gregg, foundry manager, Reliance Regulator Corp., Alhambra, Calif., has been elected a director of American Foundrymen's Association, to fill the unexpired term of **George K. Dreher,** who resigned recently to devote full time to his duties as executive director of the Foundry Educational Foundation, Cleveland. Mr. Gregg, a member of the association since 1919, was one of the organizers and first president of its Southern California Chapter. He came to America in 1907 from the Isle of Man, studying foundry practices in a number of iron, steel and nonferrous plants in United States and Canada. From 1914 to 1927 he was associated with Steiger & Kerr Occidental Foundry, San Francisco, Hasse-Martin Iron Works, Portland, Oreg., and Keystone Iron & Steel Co., Los Angeles, also serving as consultant and apprentice instructor with the Industrial Association, San Francisco. He joined Reliance Regulator Corp. in 1927, as foundry superintendent, becoming foundry manager in 1940.

♦ ♦ ♦

S. J. Almasy, who for the last year has been general foundry foreman, Sterling Faucet Co., Morgantown, W. Va., has acquired the plant of Wesley Aluminum Casting Co., Cleveland, where he will produce aluminum castings under his own name, S. Almasy Aluminum. Mr. Almasy, connected with the foundry industry since 1902, was previously associated with Dayton Malleable Iron Co., Dayton, O., and Hill Clutch Foundry, Cleveland, as well as many ferrous and nonferrous foundries throughout the country as coremaker, molder and foreman.

♦ ♦ ♦

Edward F. Dobson, until recently president, Rundle Mfg. Co., Milwaukee, has been elected president and a director of the Florence Stove Co., Gardner, Mass. Mr. Dobson succeeds **Robert L. Fowler,** former president of Florence Stove Co., who remains chairman of its board of directors.

♦ ♦ ♦

Harold Duprey, recently discharged from the Army, and formerly associated with Indianapolis Brass & Aluminum Foundry Inc., Indianapolis, has been

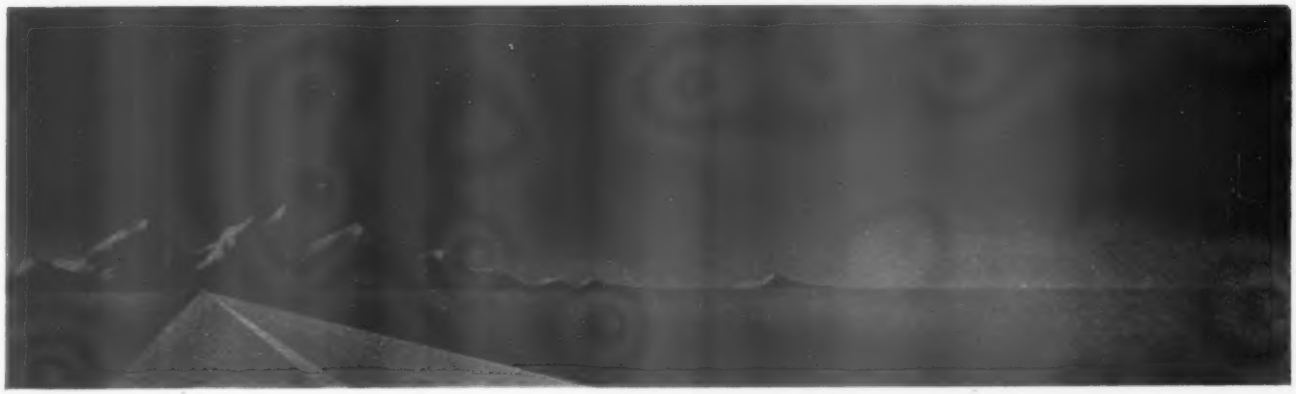
(*Continued on page* 104)

CHARLES E. NELSON

FRANK E. WARTGOW

REAR ADM. WILLIAM GRANAT

ROBERT R. GREGG



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TROY T. ALVERSON

(*Continued from page* 102)
appointed foundry superintendent, A-B-C Foundry, Indianapolis, succeeding **Howard Gossett.**

♦ ♦ ♦

Troy T. Alverson has been appointed assistant manager of the Dust and Fume Control Division, American Wheelabrator & Equipment Corp., Mishawaka, Ind. Mr. Alverson was formerly a district sales representative for the company, with headquarters in Baltimore. Previous connections include Glenn L. Martin Co., Baltimore; manager of a Navy shell plant during the war; Maryland Sanitary Mfg. Co., Baltimore; and general superintendent, Crane Co., Chattanooga, Tenn. **Fred E. Uhl** has been appointed district sales representative of American Wheelabrator, succeeding Mr. Alverson in Baltimore. Mr. Uhl was formerly a sales engineer for Westinghouse Electric Corp., New York.

♦ ♦ ♦

Howard C. Gollmar, president of the Northeastern Ohio Chapter of the American Foundrymen's Association for the year 1947-48, is general manager, Elyria Foundry Division of Industrial Brownhoist Corp., Elyria, O. Mr. Gollmar began his business career at National Tube Co., Lorain, Ohio, where he remained for two years. He entered Elyria Foundry as an apprentice in the pattern shop, later becoming foreman of that department. He was made assistant manager of the foundry in 1940 and early this year become general manager. An active member of the Northeastern Ohio Chapter, he served as a director from 1943 to 1946.

♦ ♦ ♦

George P. Fisher, director of personnel, Whiting Corp., Harvey, Ill., has been elected a vice president. Mr. Fisher, who joined the company in 1917 as a converter steel expert, was in charge of the foundry for many years. **A. J. Grindle,** who has been manager of the foundry equipment department for the past 2 years, has been elected vice president in charge of foundry equipment sales. Mr. Grindle, who originated the first successful system for melting malleable iron with pulverized coal, was manager of the pulverized coal department, Grindle Fuel Equipment Co., Harvey, when it became a subsidiary of Whiting Corp. For a while he headed his own company, Grindle Fuel Equipment Co., there, and returned to Whiting in 1941 in the foundry equipment sales department. **J. Clyde Thomas,** since 1944 treasurer of the corporation, has been elected secretary and a member of the board of directors, succeeding **R. A. Pasco,** who has resigned.

♦ ♦ ♦

Charles J. P. Hoehn Sr. has retired as president, Enterprise Engine & Foundry Co., San Francisco, but will remain on the board of directors, also serving as special consultant. Mr. Hoehn entered the foundry industry in 1890 as an apprentice molder with the Enterprise Foundry Co. He has been active on the West Coast for many years in the interests of the American Foundrymen's Association, of which he has been a member since 1924. He served as president of Northern California Chapter, AFA, during 1937-38. **William E. Butts**

FRED E. UHL

succeeds Mr. Hoehn as president of Enterprise Engine & Foundry Co. Mr. Butts is also vice president, General Metals Corp., Oakland, Calif., and will retain that position, continuing an active interest in its foundry and casting work.

♦ ♦ ♦

Timothy L. Sullivan, foreman at the Pittsburgh plant of Federated Metals Division, American Smelting & Refining Co., retired recently after 52 years of service. Fellow employees presented him with a plaque in recognition of his long association with the company. Mr. Sullivan joined the company as a scrap sorter at the age of 15, and was made general foreman in 1920.

♦ ♦ ♦

W. F. Brennan has returned to Stedman's Foundry & Machine Works, Aurora, Ind., where he was formerly production engineer. Mr. Brennan left the company in 1944 and served two years with the Navy. Recently he has been production supervisor, Franklin Transformer Mfg. Co., St. Cloud, Minn.

♦ ♦ ♦

John A. Claussen has been engaged by the Committee on Merchant Pig Iron of the American Iron & Steel Institute, New York, to devote his time to mer-

(*Continued on page* 108)

HOWARD C. GOLLMAR

J. CLYDE THOMAS

A. J. GRINDLE

GEORGE P. FISHER

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

35 Years Ago

THIS FOUNDRY FOUND THE ANSWER

How to maintain production while keeping grinding costs down? Today that's a big worry—but even back in 1912 a well-known malleable iron foundry was faced with the same problem, and the management found the answer because they knew where to look for it.

They knew that wheels made by "U.S." were originated in 1863.

They knew that "U. S." had research facilities which not only thoroughly covered abrasives and bonds, but also extended into all the fields covered by the many products of United States Rubber Company.

And they knew that "U. S." would come up with the type of wheel that would meet requirements.

This foundry picked U. S. Wheels and has been using them ever since.

Whether you're snagging castings or grinding ball races, there's a U. S. Royalite Wheel engineered precisely to the job—carefully tested in both factory and laboratory.

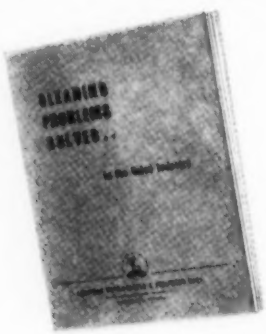
For your own particular needs, you can obtain *in advance* accurate grinding costs with U. S. Royalite Wheels from one of our trained field engineers, who will make thorough tests right in your own plant.

Write to Mechanical Goods Division, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

U. S. ROYALITE GRINDING WHEELS

Engineered to your job

CLEANING PROBLEMS SOLVED



Free: our new illustrated booklet, "CLEANING PROBLEMS SOLVED in Valve Industry." Write for your copy: it contains thorough case history data, comments from users, photos of Wheelabrated products, installation views, and types of equipment recommended in this field.

A Few of the Valve Manufacturers using WHEELABRATORS

The Ohio Injector Co.
Jenkins Bros.
Crane Company
Sloan Valve Co.
The Westcott Valve Co.
Globe Valve Corp.
Kunkle Valve Co.
Ohio Brass Co.
The Chapman Valve Mfg. Co.
Allis-Chalmers Mfg. Co.
Walworth Co.
Worthington Pump & Machinery Corp.
American Valve Co.
Kennedy Valve Mfg. Co.
Rensselaer Valve Co.
The Lunkenheimer Co.
H. B. Salter Mfg. Co.
Grinnell Co.
Milwaukee Valve Co.

WHEELABRATOR'S faster cleaning PAYS OFF in INCREASED PRODUCTIVITY for VALVE MANUFACTURERS

Into the J. B. Beaird Company's busy foundry at Shreveport, La. went a 30 cu. ft. Wheelabrator Tumblast to give them a FASTER, LOWER COST way to clean steel valves weighing from 10 ounces to 1500 pounds. While Company Officials stood by, the WHEELABRATOR took on a HALF TON LOAD of 10 ounce castings. In precisely FIVE MINUTES, these emerged with PERFECT SURFACES — sandless, burrless, scaleless! Next came a massive, 1500 pound gate valve. With amazing speed, it was ready for after-cleaning inspection. And the job was pronounced BETTER IN ALL WAYS!

Nationwide, the cost-lowering high speed of WHEELABRATOR cleaning is setting new PRODUCTIVITY RECORDS for the metal industry.

CAN YOUR CLEANING ROOM MATCH THESE PRODUCTION FIGURES?

"Former cleaning methods (airblast and wet tumbling) took 45 minutes for 50 pound loads. 2 cu. ft. capacity Wheelabrator cleans 100 to 250 pound loads in 3 to 4 minutes" . . . Trenton, N. J., Brass Foundry.

"Old method of hand type cleaning required continuous operators, couldn't clean deeply recessed parts. Wheelabrator reduced cleaning time 70%, former labor costs cut 80%, former maintenance costs cut 90%. High speed cleaning keeps work moving; consequently, creates more space" . . . Edward Valves, Inc., East Chicago, Indiana.

"Wheelabrated valves cleanest ever sent out. 5 to 6 minutes to clean loads from 1800 to 4200 pounds" . . . Plant engineer, Louisville, Ky., Valve Company.

"Increased tool life due to Wheelabrated sand-free castings means a saving of $3,000.00 annually" . . . Michigan Manufacturing Plant.

American
WHEELABRATOR & EQUIPMENT CORP.
(FORMERLY AMERICAN FOUNDRY EQUIPMENT CO.)
505 S. Byrkit St., Mishawaka 2, Indiana

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

(*Continued from page* 104)

chant pig iron. The committee was formed in 1945 and consists of representatives of companies producing merchant pig iron. Mr. Claussen was active in selling pig iron in New York, for many years, followed by service with governmental agencies.

♦ ♦ ♦

Marvin W. Williams, chairman of the Texas Chapter of the American Foundrymen's Association for the year 1947-48, has been foundry manager of the Hughes Tool Co., Houston, since 1945. Mr. Williams, a native Texan, was graduated from University of Texas in 1935, with a degree in mechanical engineering. Following graduation he became associated with the Hughes Tool Co., in the sales department. Besides active participation in the American Foundrymen's Association, Mr. Williams is a member of the Steel Founders' Society of America, American Society for Metals, and Texas Society of Professional Engineers.

♦ ♦ ♦

Dr. Frank C. Croxton, formerly head of chemical research, Battelle Memorial Institute, Columbus, and associated with it since 1939, has been named one of six new assistant directors recently appointed by that institution. **Dr. Clarence H. Lorig,** who has been in charge of foundry technology research there, and with the institute since 1930, has also received such an appointment. The other assistant directors include: **Dr. Howard W. Russell,** chief physicist since the institute was originated; **Ralph A. Sherman,** in charge of research in the field of fuels technology since 1930; **Clarence E. Sims,** formerly head of research in process metallurgy, and a member of the staff since 1936; and **John D. Sullivan,** currently serving as national president of the American Ceramic Society, and also a veteran member of the Battelle staff, well known in the metals and ceramic industries. The new assistant directors will share with Director **Clyde Williams** and **Dr. Oscar E. Harder,** assistant director since 1930, in the technical direction of research at the institute.

♦ ♦ ♦

Ronald Tipping has joined the sales staff of Don Barnes Foundry Supplies & Equipment, Hamilton, Ont., and will cover the territory from Hamilton to Kingston. Mr. Tipping was formerly

RONALD TIPPING

foundry superintendent, Otis Fensom Elevator Co. Ltd., where he was also in charge of Meehanite metal sales development. During the early part of the war, Mr. Tipping was plant superintendent, Delmere & Williams Ltd., Toronto, leaving there in 1941 to handle subcontract work for Otis Elevator Co. Ltd.

♦ ♦ ♦

Joseph C. Huehn, comptroller, National Bearing Division, American Brake Shoe Co., New York, has been elected president of the St. Louis control, Controllers Institute of America, New York, a technical and professional organization devoted to improvement of controllership procedures. **Frank V. Bigelow,** treasurer and controller, Malleable Iron Fittings Co., Branford, Conn., has been named secretary-treasurer of the Bridgeport, Conn., control and **E. L. Stewart,** treasurer, Sandusky Foundry & Machine Co., Sandusky, O., secretary of the Toledo control. Members of the industry elected directors by local branches of the institute in their respective cities, include: **A. Dale Mitchell,** assistant treasurer and controller, Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. (Hartford control); **C. Howard Paul,** treasurer and assistant to the president, Mackintosh Hemphill Co., Pittsburgh; and **Clyde R. Dean,** assistant treasurer and office manager, Electric Steel Foundry Co., Portland.

♦ ♦ ♦

Joseph B. Meier has established himself as sales representative for foundry equipment and supplies in the eastern Atlantic area. Products handled include shot and grit for Clayton Sherman Abrasives Co., Detroit, and grinding and cutoff wheels for General Grinding Wheel Corp., Philadelphia. Mr. Meier has had about 20 years of industrial experience, and for the last five years was in charge of casting prices at the Office of Price Administration, Washington. His headquarters are at 3 Sunnyside Terrace, East Orange, N. J.

♦ ♦ ♦

H. Barnett has been appointed vice president and general manager, Welland Electric Steel Foundry Ltd., Welland, Ont. Before joining the company 3 years ago as works manager, Mr. Barnett was director of research at the government-owned Electric Steels Ltd., Three Rivers, Que. Prior to that he was in the plant research department of Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

♦ ♦ ♦

C. H. Megaw, until recently head of the metals division, War Assets Administration, Philadelphia regional office, has been elected vice president in charge of foundry sales, K. Hettleman & Sons

(*Continued on page* 110)

MARVIN W. WILLIAMS

DR. CLARENCE H. LORIG

CLARENCE E. SIMS

JOHN D. SULLIVAN

When the going gets ROUGH

and Safety comes First....

BAY STATE SNAGGING WHEELS are best by test!

Yes, the Roughest and Toughest jobs are just made to order for Bay State Snagging Wheels and Cones. For ruggedness is an essential quality of every Bay State grinding wheel. What's more, Bay State resinoid and vitrified bonds are an assurance of faster, cleaner stock-removing action and its resultant increased economy. Then, too, the Toughest of jobs are accomplished in greater safety than ever before . . . due to Bay State's patented method of rigidly imbedding a steel nut in the taper cut shapes (Pat. No. 2,172,243). All these features combined make Bay State Snagging Wheels and Cones the best in efficiency, safety, and economy. Detailed information bulletins concerning all types of snagging wheels are available upon request.

Branch offices & warehouses — Chicago, Detroit
Distributors — All principal cities

BAY STATE*

*Reg. U. S. Pat. Office

Top Performance Consistently Duplicated

BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

(*Continued from page* 108)

Inc., Baltimore. Mr. Megaw, who has been associated with the nonferrous metals industry for more than 30 years, was formerly with Ajax Metal Co. and Acme Metals Refining Corp., both of Philadelphia.

♦ ♦ ♦

R. H. Swartz, recently elected chairman of the Quad City Chapter of the American Foundrymen's Association, is president and general manager, Riverside Foundry, Bettendorf, Iowa. Mr. Swartz was graduated from Bradley University, Peoria, Ill., and for several years was associated with Caterpillar Tractor Co., and Keystone Steel & Wire Co., Peoria, in their metallurgical departments. Later he was with Northwestern Steel & Wire Co., Sterling, Ill., in charge of laboratories and control. In 1937 Mr. Swartz joined the Bettendorf Co., Bettendorf, Iowa, as chief metallurgist and superintendent of production. When Campbell, Wyant & Cannon acquired the plant and operated it as Ordnance Steel Foundry Co., he remained as manager of metallurgy and production superintendent. When the plant was closed he became president and part owner of Ferro-Bronze Corp., Moline, Ill., manufacturer of gray iron and nonferrous castings. In 1946 he was one of a group that acquired from War Assests Administration the Zimmerman Steel Casting Co., Bettendorf, which is now operated as Riverside Foundry. Last year Mr. Swartz served as vice chairman of the Quad City Chapter and the previous year was chairman of the Tri-City Chapter of the American Society for Metals.

♦ ♦ ♦

Ralph M. Trent, for 14 years manager of Pittsburgh and central Pennsylvania district, Pangborn Corp., Hagerstown, Md., has been transferred to the Pacific coast in charge of that area. Mr. Trent, for the present, will be located in San Marino, Calif., until a new office is opened in Los Angeles. **John D. Wise,** formerly director of purchases, and district sales representative in the Chicago district since 1945, succeeds Mr. Trent as manager of the Pittsburgh district. **Frank Newell** has been transferred to the Chicago office as district sales engineer under direction of **L. W. Wagner,** district manager there. Mr. Newell has completed two years of service in sales engineering at the home office in Hagerstown, following 6 years of field work throughout the Middle West.

♦ ♦ ♦

H. R. Williams has established Williams Management Engineering, with offices in the Commerce Bldg., Milwaukee. Mr. Williams has had many years of experience in handling wage incentive plans, job evaluations, plant layout and production and cost controls, specializing in foundry problems. He was formerly a partner in Williams & Hansen, industrial management engineers in Milwaukee, which was dissolved recently.

H. R. WILLIAMS

♦ ♦ ♦

George A. Custer has been elected vice president in charge of manufacturing, and **C. H. Rickenback** has been appointed assistant secretary, Peninsular Grinding Wheel Co., Detroit. Mr. Custer has been factory superintendent for 2 years and chief engineer for 8 years. Mr. Rickenback has been office and personnel manager for the company.

♦ ♦ ♦

O. L. Howland has been appointed sales manager of the Welding Division, Metal & Thermit Corp., New York, with headquarters in Chicago. Mr. Howland has been district manager there since he joined the company in 1943. A graduate of University of Wisconsin, he was associated previously with Central Steel & Wire Co., Chicago Lincoln Electric Co., Cleveland, Koro Corp., a welding supply organization, and Hollup Corp., Chicago. During World War II he headed the Welding Division, War Production Board, Washington.

♦ ♦ ♦

David W. Hopkins has been appointed executive vice president, R-S Products Corp., Philadelphia, in charge of the valve, furnace and manufacturing divisions. Mr. Hopkins, a graduate of University of Pennsylvania, has been associated with the company since 1939, and until recently was in charge of the valve division.

♦ ♦ ♦

Dr. Gurdon M. Butler Jr. has been appointed senior engineer of the Research Division, the Carborundum Co., Niagara Falls, N. Y. Dr. Butler was formerly associate director of research of the Tool and Die Steel Division, and later chief metallurgist at the Dunkirk, N. Y., plant of the Allegheny Ludlum Steel Corp.

♦ ♦ ♦

William Toni has been named superintendent of the centrifugal molding department at Swayne, Robinson & Co., Richmond, Ind., succeeding **Richard Wright.**

♦ ♦ ♦

Bert Arant, formerly affiliated with the melting departments of Universal-Cyclops Steel Corp., has joined the Ti-

(*Continued on page* 112)

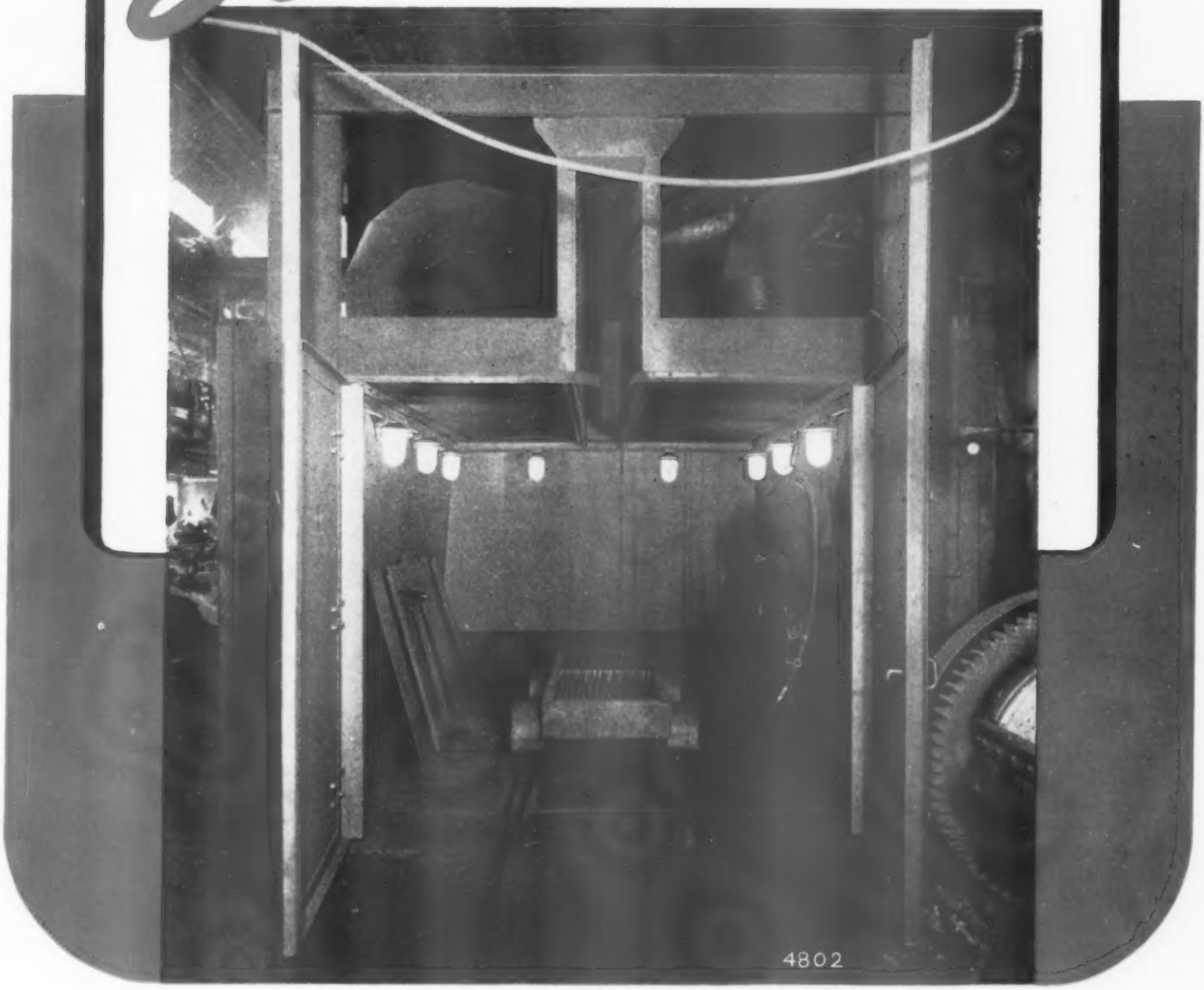
R. H. SWARTZ

FRANK NEWELL

RALPH M. TRENT

JOHN D. WISE

SLY BLAST ROOMS *Better-Built* OFFER EXCLUSIVE ADVANTAGES



A typical Sly Blast Room for a jobbing foundry

Castings of moderate weight are placed against the sidewall for cleaning as shown; heavier castings are handled on the car. Provision has also been made for future installation of a monorail.

Excellent illumination—from an ample number of dust-tight lighting fixtures.

Construction is exceptionally rigid—walls and doors have an extra layer of steel (3/16" wear plates).

The ceiling is of *triple* construction and provides over-all down-draft ventilation.

The floor is made of grating and perforated plates. It is unmatched for strength and safety.

Before you buy, it will pay you to look into these exceptional features of Sly Blast Rooms. We shall be glad to send you full information or arrange for representative to call.

THE W. W. SLY MANUFACTURING CO. • 4753 Train Avenue Cleveland 2, Ohio

SLY INDUSTRIAL DUST CONTROL

TUMBLING MILLS ⊂ BLAST CLEANING EQUIPMENT

(*Concluded from page* 110)

tanium Alloy Mfg. Co. as development engineer. Mr. Arant will work in the western Pennsylvania and Ohio districts.

♦ ♦ ♦

James B. Elliott, until recently divisional manager for plant products at the Caldwell plant of Link-Belt Co. at Chicago, has been appointed divisional sales manager at its plant in Minneapolis. Mr. Elliott, who joined the company in 1925, previously was district sales engineer in the Minnesota, Wisconsin and upper peninsula of Michigan territory. **Erwin A. Wendell** succeeds Mr. Elliott at the Caldwell plant. He joined the Pershing Road plant engineering department in 1918 and served as district sales manager at St. Louis from 1937 to 1944, when he became district sales manager at the Pershing Road plant. **T. W. Matchett,** formerly district sales engineer at New York, has been transferred to the Pershing Road plant to succeed Mr. Wendell as district sales manager of the Chicago branch. Mr. Matchett, a graduate of Lehigh University, joined the Link-Belt sales department in Chicago last year after 13 years of experience in the conveyor business.

♦ ♦ ♦

E. C. Troy, chairman of the Philadelphia Chapter of the American Foundrymen's Association for the year 1947-48, is vice president in charge of research and development, Dodge Steel Co., Philadelphia. Mr. Troy spent 2 years with Detroit Steel Casting Co., Detroit, as assistant chemist, following graduation from high school, and then entered Michigan College of Mining and Technology, where he received his degree in metallurgical engineering. He returned to Detroit Steel Casting Co., as assistant to the vice president and metallurgist. In 1937 he joined Dodge Steel, as metallurgist, and was appointed chief metallurgist in 1942. An authority on risering and sand control measures, Mr. Troy is also an active member of various technical organizations. He served as vice chairman of the Philadelphia Chapter of the AFA, last year.

♦ ♦ ♦

L. W. Hayden has been named resident vice president of Lindberg Engineering Co. at New York, and will be in charge of all east coast sales offices as well as all export sales. **G. W. Helsberg,** formerly in New York, is now in

L. W. HAYDEN

charge of the Boston office, and **R. W. Dougherty,** formerly in charge of the Kalamazoo, Mich., office, will be in charge of a new Lindberg office to be opened in Philadelphia. **S. K. Oliver,** formerly in New York, will move to the Cleveland office and **T. M. La Crone,** formerly with General Motors, has been placed in charge of the Kalamazoo office.

♦ ♦ ♦

Dr. Floyd J. Metzger, vice president in charge of liquefaction research, Air Reduction, New York, has resigned to engage in private practice as a consultant in New York. He will continue on a consulting basis with Air Reduction, which he joined over 30 years ago from a professorship in chemical engineering at Columbia University. **Morrough P. O'Brien,** formerly dean of engineering, University of California, has been appointed to succeed Dr. Metzger and will be in charge of general and process engineering as well as direction of liquefaction research.

♦ ♦ ♦

Boyd V. Giesey, for the last two years in charge of the Flash Welder Division, Progressive Welder Co., Detroit, has been put in charge of its new office, recently opened in Lansing, Mich., and will handle sales of resistance welding equipment in Michigan, north of Detroit. Mr. Giesey, who was formerly senior design engineer for Taylor-Winfield Corp., Warren, O., will be assisted by **Robert O. Wight,** in the new office. Mr. Wight was formerly welding applications engineer for the company.

♦ ♦ ♦

R. W. Kise has been appointed manager of sales, industrial heaters and devices section, General Electric Co., Schenectady, N. Y. Mr. Kise joined General Electric in 1930 and following completion of its business training course he was assigned to advertising and sales promotion work.

♦ ♦ ♦

Morris F. Jacobs, 3321 N. Frederick Ave., Milwaukee, has been appointed Wisconsin representative for Illinois Testing Laboratories Inc., Chicago. Mr. Jacobs, who has had many years' experience in the instruments field, will represent the complete line of Alnor instruments on an exclusive basis.

♦ ♦ ♦

James Meekin, former manager of Vetco Products Corp., Huntington, Ind., has been named foundry superintendent at Dill Inc., Rushville, Ind.

♦ ♦ ♦

Guy Hamilton, formerly of Moline, Ill., has been appointed foundry superintendent, Lakeside Foundry Co., Warsaw, Ind., succeeding **Jacob Brendel.**

(*Concluded on page* 114)

JAMES B. ELLIOTT

T. W. MATCHETT

ERWIN A. WENDELL

E. C. TROY

Quantity
PRODUCTION
of
GREY IRON CASTINGS

ONE OF THE NATION'S
LARGEST AND MOST MODERN
PRODUCTION FOUNDRIES

ESTABLISHED 1866

THE WHELAND COMPANY

FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS

CHATTANOOGA 2, TENNESSEE

(*Concluded from page* 112)

William U. Townsend has been appointed assistant manager of the Industrial Division, National Gypsum Co., Buffalo, and in that capacity will have charge of industrial plasters for foundry molding purposes. **David H. Shearer** has been named industrial sales manager in the eastern district. They have been associated with the company for over 7 years.

♦ ♦ ♦

Frank W. Klatt, previously general manager of the W. W. Sly Mfg. Co., Cleveland, has been elected president, succeeding the late S. C. Vessy. Mr. Klatt was graduated from Case Institute of Technology in 1908, and was industrial engineer for National Carbon Co., Cleveland, from 1912 to 1920. The ensuing 6 years he spent with the Sly company as general manager. From 1927 to 1939 Mr. Klatt was managing director of General Motors Corp. in India, returning to this country and rejoining the Sly Co.

♦ ♦ ♦

Jerold Van Alsburg has been appointed Ohio sales representative for the Rapids-Standard Co. Inc., Grand Rapids, Mich., with headquarters in Toledo. Mr. Alsburg, associated with Hart & Cooley Mfg. Co., Holland, Mich., for 18 years, spent 4 years in the Navy, two of which were devoted to equipment design in Washington.

♦ ♦ ♦

Charles Stanton has been appointed district field engineer in the Philadelphia office, Chain Belt Co., Milwaukee. Mr. Stanton formerly held a similar position in the company's Detroit office.

♦ ♦ ♦

James E. Chasmar has been appointed works manager of the Watertown, Mass., plant of Manning, Maxwell & Moore Inc., New York.

♦ ♦ ♦

Charles A. Evans, formerly representative of the Chicago district sales office, Aluminum Co. of America, Pittsburgh, has been appointed an assistant product manager for the castings division, with headquarters at the company's plant at Vernon, Calif. A native of Youngstown, O., Mr. Evans attended Carnegie Institute of Technology and joined Aluminum Co. in 1935, at the New Kensington, Pa., works. He was transferred to the Chicago sales office the following year and since 1940 has been connected with the castings sales branch there.

♦ ♦ ♦

E. S. Cramer, recently of the sales engineering department, Norton Co., Worcester, Mass., has been appointed abrasive engineer for a section of the Pittsburgh district, replacing **L. W. Grubbs** who has resigned to enter the field of consulting mechanical engineering.

♦ ♦ ♦

Fred C. Bond has been appointed technical director and **Will Mitchell Jr.,** director, of the basic industries research laboratory, Allis-Chalmers Co., Milwaukee. **Bruce H. Irwin** has been named assistant laboratory director and director of training for the department.

♦ ♦ ♦

Julius A. Kayser, formerly vice president and general sales manager, Laclede-Christy Clay Products Co., St. Louis, has been appointed assistant to the president. Mr. Kayser has been with the company for the last 24 years.

♦ ♦ ♦

Edward M. Sarraf has been appointed district sales manager of the Cleveland office of Harbison-Walker Refractories Co., Pittsburgh, succeeding **R. Pollock Balph** who has retired following 40 years of service.

♦ ♦ ♦

Lt. Col. S. C. Guillan has been appointed secretary of the British Institute of Metals, and editor of its publications.

♦ ♦ ♦

Joseph W. Lodge has been appointed to the staff of Battelle Institute, Columbus, O., where he will engage in research in foundry technology. Mr. Lodge until recently was a metallurgist for the Wheeling Steel Corp., Wheeling, W. Va.

♦ ♦ ♦

Carra L. Lane has been made vice president and works manager, Schaible Co., Cincinnati. Mr. Lane has been works manager, Lunkenheimer Co., Cincinnati, for over two years.

♦ ♦ ♦

Marshall E. Neil has been appointed general sales manager, Mid-States Equipment Corp., Chicago, and will direct distribution of the company's welders.

DAVID H. SHEARER

WILLIAM U. TOWNSEND

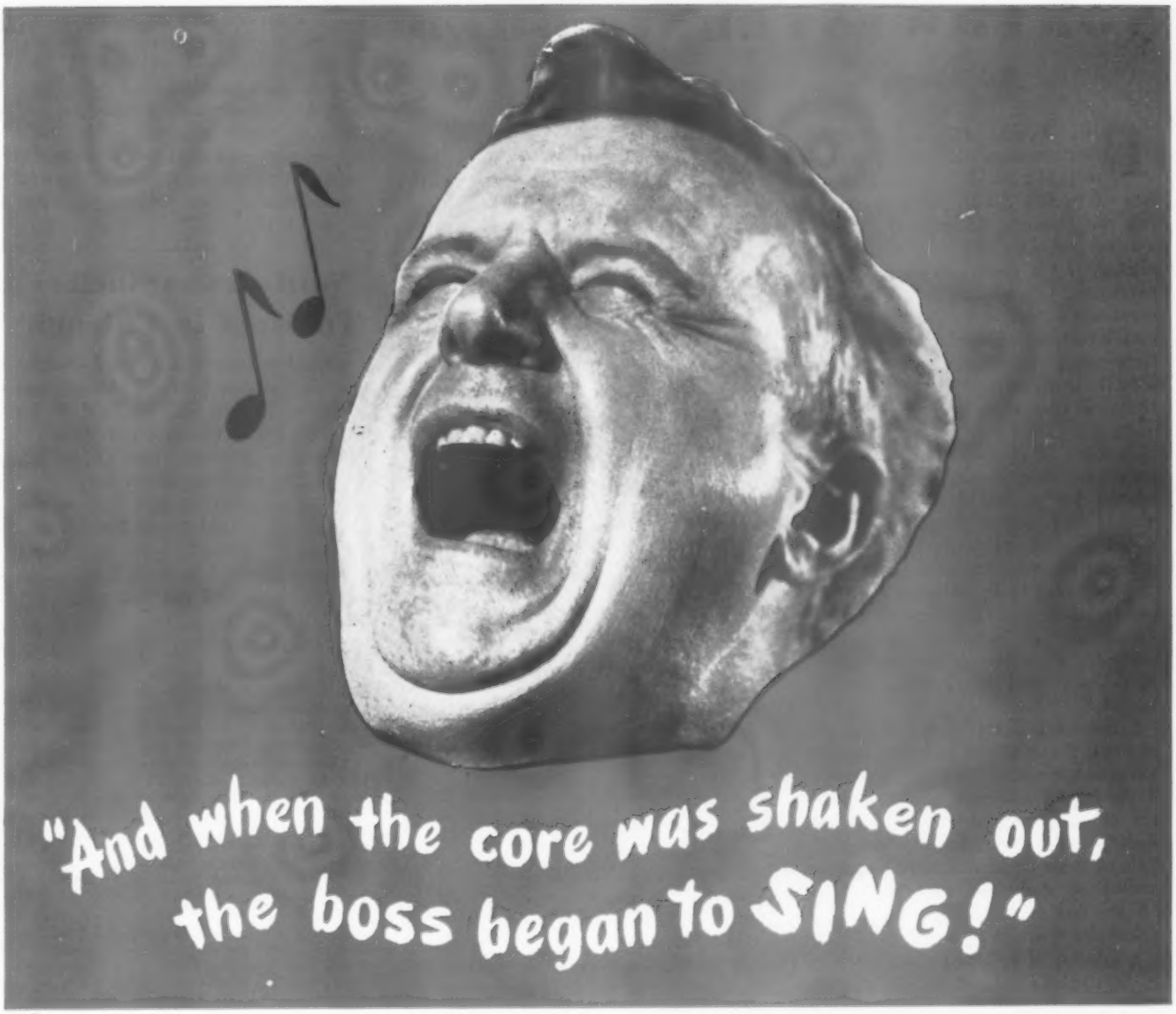
Chicago Is Host to Metal Congress

Twenty-ninth annual National Metal Congress and Exposition will be held in Chicago from Oct. 18 through Oct. 24. Approximately 375 firms and organizations will display and operate metalworking equipment and products during the seven days. Exhibits will occupy approximately 240,000 square feet of floor space on both levels of the International Amphitheatre.

National Metal Congress again will combine technical sessions of the American Society of Metals, American Welding Society, Iron and Steel, and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers, and the American Industrial Radium and X-ray Society.

Technical sessions of the American Society for Metals mainly will be devoted to heat treatment ranging from theoretical studies of phase transformations to practical applications of induction hardening. High temperature alloys and properties of metals at both high and low temperatures, steelmaking problems, light metals and other nonferrous alloys, metalworking and testing also will be discussed. In addition two special lecture courses and a seminar will be held. One of the lecture courses will be on "Introductory Physical Metallurgy" to be presented by C. W. Mason, Cornell University, and the other is on "Copper and Copper Alloys" by O. W. Ellis, Ontario Research Foundation. The seminar arranged in co-operation with Case Institute of Technology will be devoted to a discussion of "Fundamental Relations in the Fracture of Metals".

Annual meeting of the American Society for Metals will be held Wednesday, at which Dr. C. H. Mathewson, Yale University, will receive the gold medal of the society for "outstanding metallurgical knowledge and great versatility in the application of science to the metal industry as well as exceptional ability in the diagnosis and solution of diversified metallurgical problems." Campbell Memorial Lecture will be delivered by Dr. A. B. Kinzel, Electro Metallurgical Co



"NEVER saw cores behave so well before. From the time they were nothing but a pile of mix, their behavior has brought joy to the most critical coremaker. Plenty of green strength; better permeability; no sticking; and they collapse like a tired pup on a pillow. Look at these castings! They're smooth and sharp. The whole batch is dog-gone near perfect. And, believe me, that's the way to make core room costs toe the mark.

"We're using Krause Cereal Binders in our coremaking. Some like the lightweight — *TRUSCOR*, the Krause people call it; some like the heavyweight — *AMERIKOR*, by name. My core making troubles flew right out of the window when we started using Krause cereal binders, so I'll pass along a tip — make your choice either lightweight or heavyweight — but just be sure it's a Krause Cereal Binder."

We can't add much more to the boss' story except to remind you that on your next order, ask for Krause cereal binders — *TRUSCOR* for lightweight; *AMERIKOR* for heavyweight. And if you have a core problem that needs solving, phone, write or wire us the details. We'll be glad to help you.

CHAS. A. KRAUSE MILLING CO., Milwaukee 1, Wis. • *World's Largest Millers of Dry Corn*

CEREAL BINDERS

DISTRIBUTORS

M. A. Bell Co., St. Louis 2, Mo.
A. L. Cavedo & Son, Inc. Richmond 21, Va.
Foundry Supplies Co., Chicago 16, Ill.
J. H. Hatten, Lansdowne, Pa.
Independent Foundry Supply Co., Los Angeles 11, Calif.
Marthens & Co., Moline, Ill.
Carl F. Miller & Co., Seattle 4, Wash.
Milwaukee Chaplet & Mfg. Co., Milwaukee 4, Wis.
Pacific Graphite Works, Oakland 8, Calif.
Porter-Warner Chattanooga 2, Tenn.
Smith-Sharpe Co., Minneapolis 14, Minn.
Frederic B. Stevens, Inc., Buffalo 12, N. Y.
Frederic B. Stevens, Inc., Cleveland 14, Ohio
Frederic B. Stevens, Inc., Detroit 26, Mich.
Western Industrial Supply Co. 208 S. E. Hawthorne Blvd. Portland 14, Oregon

NORTHWESTERN ADDED

As Sixth Foundation School

THE Technological Institute of Northwestern University, Evanston, Ill., has been added as the sixth university which is co-operating with the Foundry Educational Foundation in providing foundry engineering training, it has been announced by the foundation. Other schools at which the foundation's program previously had been initiated include Case Institute of Technology, University of Cincinnati, Cornell University, Massachusetts Institute of Technology and University of Wisconsin.

Inclusion of Northwestern in the program was made desirable by the heavy demand for graduates in the Chicago area. Initial conversations were conducted in Chicago under the guidance of Bruce Simpson, National Engineering Co., which led to an invitation to Northwestern to join the movement. Formal acceptance was received by Anthony Haswell, president of the foundation, from Dean Ovid W. Eshbach late in August.

A dominant factor in the discussions between the institute and the foundation was the co-operative training policy of the former. Students, after two quarters of the sophomore year are concluded, enter industry for alternating periods of three months of work and three months of study. In all, six quarters (18 months) of industrial work are required for graduation.

A number of excellent foundries exist in the Chicago area which can give the student practical training during his college program. The combination is expected to give an extremely desirable program for the training of supervisory engineers.

Equipment and facilities of the institute are among the finest of any university in the United States. Its foundry, provided with sand preparation, molding, melting and pouring equipment, was described in detail in THE FOUNDRY, August, 1942. Of particular interest are the 5,000,000-lb. compression machine and the 1,000,000-lb. universal testing machine which offer expanded research possibilities in connection with the foundry program.

The foundry program has been placed in charge of Prof. Burgess H. Jennings, chairman of the department of Mechanical Engineering. Assistant Prof. Ray S. Lindenmeyer is in charge of the laboratories.

OVID W. ESHBACH

The institute has recently added Richard H. Cole as a lecturer in the Mechanical Engineering Department. He was formerly head of the Industrial Arts Department at Millikin University, Decatur, Ill. His work at Northwestern will place him in charge of the foundry laboratory under Professor Lindenmeyer, and will be very closely allied with the foundry program.

Northwestern is ready to accept students who will follow the foundry program. Full details will be worked out for use at the beginning of the mid-winter quarter which starts Jan. 1, 1948. Foundation scholarships are being made available. Interested prospective students are urged to obtain further information as to admittance by writing or visiting Raymond A. Kliphardt, registrar, Northwestern Technological Institute, Evanston, Ill.

Nonferrous Society To Meet in Chicago

Annual meeting of the board of directors and members of the Non-Ferrous Founders' Society will be held at the Sheraton Hotel, Chicago, Oct. 16-17.

Thursday afternoon, Oct. 16, will be devoted to plant inspection tours which may be arranged through the society's national office, 127 North Dearborn St., Chicago.

Registration will begin at 8 a. m., Friday, Oct. 17, and the first meeting is scheduled for 10 a. m. The Oct. 17 program follows:

Morning Session: Reports of officers and formal election of new directors.

Luncheon Meeting: Discussion of "Future Labor Relations" conducted by Attorney Donald A. Morgan, Peoria, Ill.

Afternoon Session: "Future Chapter Activities" by Walter M. Clark, D. W. Clark & Co., South Boston, Mass. "Our Future Cost Program" by William A. Gluntz, Gluntz Brass & Aluminum Foundry Co., Cleveland. "National Castings Council" by Frank G. Steinebach, editor, THE FOUNDRY, Cleveland. Open discussion of industrial problems by Chester K. Faunt, Christensen & Olsen Foundry Co., Chicago, and society president.

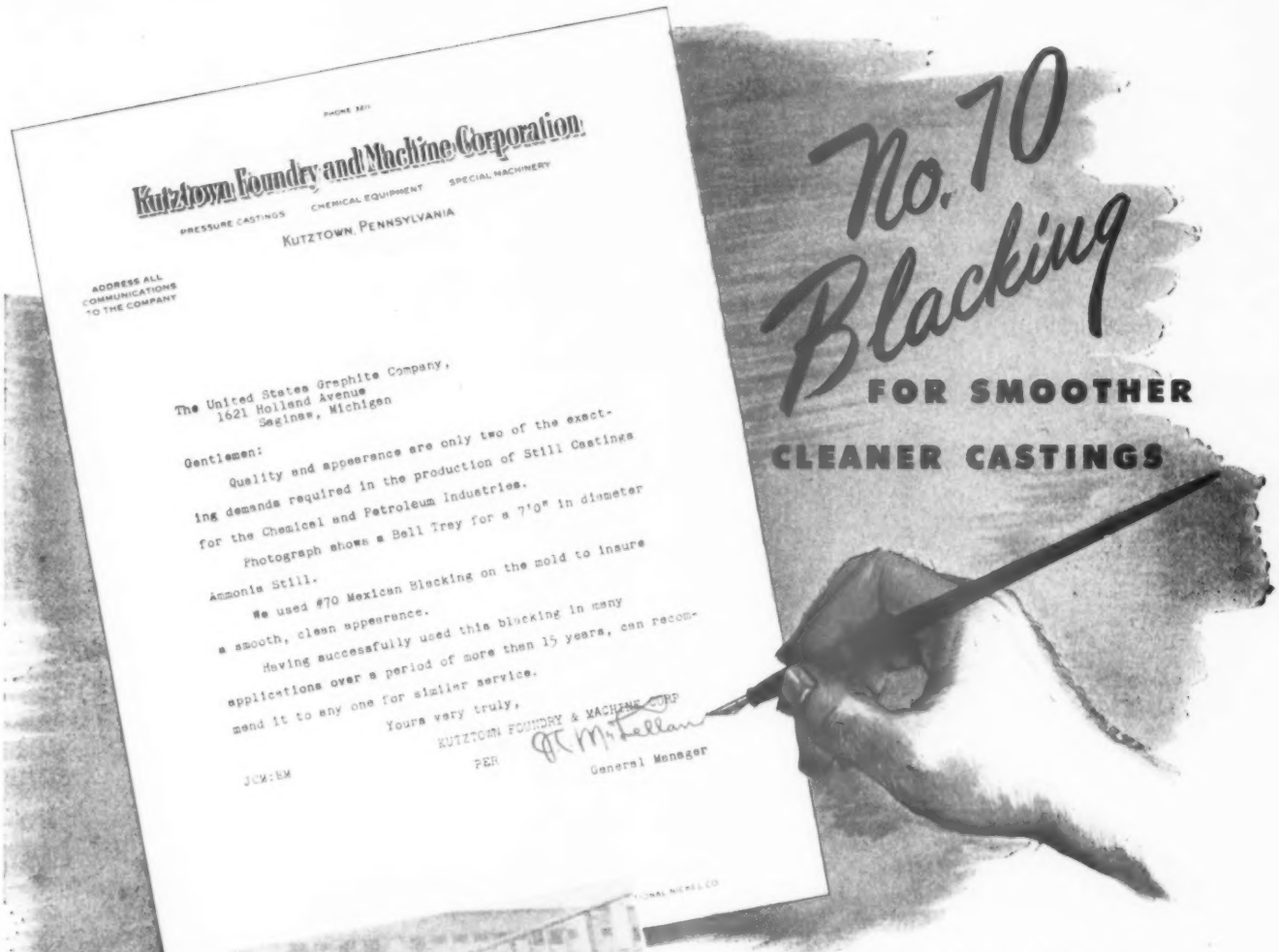
Evening Session: Reception and cocktail hour at 6 p.m. with the annual dinner for members, wives and guests at 7:30 p.m. Officers for 1948 will be introduced. Carl Taylor, president, Waukesha State Bank, Waukesha, Wis., will talk on "America and the World."

Rockwood Mfg. Co., 1801 English Ave., Indianapolis, has been sold to Homer K. York and S. W. Simpson of Indianapolis and Ben S. Naven, Chicago. The firm will be known as Rockwood Mfg. Co. Inc.

BURGESS H. JENNINGS

RAY S. LINDENMEYER

RICHARD H. COLE


Kutztown Foundry and Machine Corporation
PRESSURE CASTINGS CHEMICAL EQUIPMENT SPECIAL MACHINERY
KUTZTOWN, PENNSYLVANIA
ADDRESS ALL COMMUNICATIONS TO THE COMPANY
The United States Graphite Company,
1621 Holland Avenue
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Gentlemen:
Quality and appearance are only two of the exacting demands required in the production of Still Castings for the Chemical and Petroleum Industries.
Photograph shows a Bell Tray for a 7'0" in diameter Ammonia Still.
We used #70 Mexican Blacking on the mold to insure a smooth, clean appearance.
Having successfully used this blacking in many applications over a period of more than 15 years, can recommend it to any one for similar service.
Yours very truly,
KUTZTOWN FOUNDRY & MACHINE CORP
PER
General Manager
JCM:EM
No. 70 Blacking
FOR SMOOTHER
CLEANER CASTINGS

The smooth surfaces of this bell tray for a 7' diameter ammonia still, just one of a wide variety of castings produced by the Kutztown Foundry and Machine Corp. for the chemical and petroleum industries, require only a minimum of cleaning—thanks to No. 70 Blacking. No wonder Kutztown writes, recommending the use of No. 70 Blacking. This versatile mold coating penetrates deeply into sand surfaces to form a hard coat which turns out smoother, cleaner castings. It is economical and easy to use. No. 70 can be sifted dry through a cloth bag in treating green sand molds, for it draws sufficient moisture to bond to the sand; or it can be mixed with water to make an excellent wet blacking which assures a hard coat with maximum sand penetration for light and medium weight dry sand, skin dried and loam molds. It is also used by many production foundries to dip small baked cores which need extra protection under intense metal conditions.

- No. 70 Blacking, used by Kutztown in many applications for 15 years and preferred as a general purpose blacking by many other leading foundries, will help you to produce cleaner castings with less trouble and expense. Write for complete particulars.

THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICHIGAN

Around DETROIT

By A. H. ALLEN
Detroit Editor
THE FOUNDRY

Spiraling cost of raw materials pushes casting prices to higher levels . . . Dyes being used more widely in automotive foundries to identify different types of core sand

PRICES, like the weather, are something everybody is talking about but nobody is doing anything about, other than to exclaim an occasional tsk-tsk as the dizzy upward climb continues. Prices, of course, are only reflections of costs, and costs—in the final analysis—are tied basically to wages. Two rounds of substantial wage increases, tacked on top of hourly rates already swollen by four years of war production, have brought industry's wage bill to a record high. The return to peacetime production, with the government no longer the only customer, and the elimination of controls on prices released a powerful spring which has driven prices and costs skyward with the speed of a V-2 rocket. The trajectory is still upward and probably will continue so until this year's wage increases have been absorbed. If union pressure next year can force another round of wage boosts, something may crack.

These generalities in prices, costs and wages apply with the same vigor to the foundry industry as to any other. A good grade of cylinder block iron, with perhaps a "pinch" of alloy added, will bring 15 cents a pound in the rough casting, as against 5 or 6 cents in prewar years. Small castings of a special type of gray iron carry a price tag of as much as 30 cents a pound, unmachined; larger castings of the same material may get down to around 14 cents. Both figures are roughly double what the same castings cost in 1941. A recent buy of cylinder head water outlet castings carried a price of 11 cents a pound, and one foundryman thought he was going to get the business on a bid of 12¾ cents. They might have been bought for 5 cents a pound in the good old days.

Lest anyone think these high prices are causing the bank balances of castings suppliers to burst at the seam, it is well to take a look at some of the costs encountered in making castings these days. Pig iron is nearly double what it was in 1939, and will cost even more with higher freight rates in the offing. Foundry coke is up to around $18 a ton delivered, or 80 per cent higher than it was seven years ago. Coal figures to 400 per cent higher. Scrap is 300 per cent higher, when it can be found in the almost nonexistent free scrap market.

Sand is almost the only commodity which has shown just a moderate advance—perhaps around 25 per cent. Indications from some sales are that fire brick is up 40 per cent from 1939, fluxing some 33 per cent, fireclay over 100 per cent, core oil 300 per cent, dextrin 250 per cent, flask lumber nearly 100 per cent, crating lumber about 300 per cent, and steel grit 27 per cent.

As far as most items of major equipment are concerned, prices are probably about double the level of 1939 and pointing higher. Beyond that, no foundry, independent or captive, knows what amount of money to provide for write-off of present equipment. A dollar today is something far different from what it was in 1939, so a depreciation allowance of $100,000 seven years ago would have to be boosted to $200,000 or more to provide an equivalent amortization in terms of what the money will buy.

All industry seems to be operating in a sort of economic stratosphere as yet uncharted. The gamble is being taken that high wages will provide the sustained purchasing power necessary to sustain high prices necessary to sustain the high wages. If that sounds like a squirrel cage, then that is exactly what the country is in, and who can say what is going to stop it? If $15 billions more are to be poured into Europe over the next three years, then that is going to take a lot more high-priced castings to make a lot more high-priced trucks, agricultural equipment, machinery and the like. Some of the so-called "wise boys" in the steel trade are talking five years more of the present high level of manufacturing, but it is this observer's guess that, if prices rack up another 25 per cent advance, the whole picture may come tumbling down like a house of cards.

The foundry coke outlook continues poor, both as to quantity and quality. Coke producers say they have agents out scouring the coal fields and willing to pay through the nose for tonnage, but it just does not seem to be available. Exports appear to get first call and there is an enormous coal tonnage moving abroad—a sad thing to contemplate in the face of the tremendous European coal reserves which could be dug if they would be dug. Automotive foundries have been bothered frequently by off-analysis coke which has made necessary a careful checking and control for each coke shipment.

Pig iron is somewhat easier, one Michigan foundry recently going to a 35 per cent pig charge. Good foundry scrap, of course, has been bringing a higher price than pig iron, so it can be appreciated readily why more pig is being used in cupolas as it becomes available.

The overall gray iron picture in the automotive industry can be characterized as a trifle off the pace of earlier this year. Castings requirements are being figured closer to the line and buying adjusted to be more nearly in line with actual requirements from month to month than with what manufacturers would like to do if they could get enough steel.

Dowagiac Foundry Division of Kaiser-Frazer Corp.—former Round Oak Stove Co.—is pouring 70 tons of iron daily for flywheel housings, exhaust manifolds, oil pumps, intake manifolds, cylinder heads, bearing caps, water pumps and flywheels. Scheduled to be in production shortly is a new cylinder block line, concerning which further details will appear in THE FOUNDRY shortly.

* * *

USE of organic dyes of different standard colors as a means of identifying various types of core sand is coming into wider use in the larger automotive foundries. Ford started the practice a number of months ago, making use of a red dye to identify certain types of mixes. Packard has used green, violet and red dyes in different sands, and Pontiac currently is making studies of the advantages to be gained from dyes instead of iron oxide.

A firm in Detroit, supplier of a wide variety of industrial chemicals, has furnished these dyes and is investigating further possibilities in foundries. The materials are prepared from coal tar, are water soluble and will not stain operators' hands. Only small quantities are required, one type being used in proportions of 1 pound to 12,000 pounds of sand, another 1 pound in 24,000 pounds of sand. They may be mixed with water or added in dry form to mullers and dispersed through the sand in a matter of minutes.

The dye is stable only up to 350° F

(*Concluded on page* 120)

Foundry Conveying is a *Rough Game*

FOUNDRY CONVEYERS must be designed and built to operate under severe service. Gravity and power conveyers to be applied in this industry should have extra weight and strength built into them if they are to stay on the job. Because Mathews Engineers know foundry conveying problems, Mathews Conveyers are found in most of the great brass, steel and gray iron foundries in the United States and Canada, operating under extremely rough conditions, with a minimum of costly maintenance attention.

MATHEWS CONVEYER COMPANY
ELLWOOD CITY, PENNSYLVANIA

MATHEWS CONVEYER COMPANY WEST COAST
SAN CARLOS, CALIFORNIA

MATHEWS CONVEYER COMPANY, LTD.
PORT HOPE, ONTARIO

Engineering Offices or Sales Agencies in Principal American and Canadian Cities

(*Concluded from page 118*)

and burns out when hot metal comes in contact with the sand, requiring replenishment when the sand is reused. Since only a relatively small proportion is added to the sand mix, the cost per ton of sand is not excessive, despite the fact the price of the dye material is rather high.

Use of dyes to identify parts and materials was stimulated during the war as an aid to inexperienced workers who could not identify components by their appearanace or feel. Where assemblies were made up of a number of small parts similar in shape, it was the practice to dip the different parts in water solutions of dye to permit their positive identification by color. Interestingly enough, it was discovered color blindness was not too serious a problem, since the average factory worker seldom is bothered by inability to differentiate colors.

° ° °

BY THE time this is published, announcement will have been made of the 1948 model plans of Hudson. Except for the new Packard convertible, introduced several months ago, this is the first manufacturer to change over to a new series of passenger cars. Chevrolet, General Motors Truck and Ford all have switched to 1948 truck models. Hudson has spent about $10 million on rearranging and re-equipping its Detroit plants for manufacture of the 1948 line, which is new from stem to stern. Many important manufacturing innovations are being undertaken.

With the possible exception of Nash, there will be no more 1948 models appearing until year-end or later. At that time Chevrolet and Pontiac will make minor decorative changes, deferring entirely new bodies until a year from now. Buick, Olds and Cadillac all will have completely new bodies for their 1948 lines, which are due for production in January. There is some talk heard of 30-day shutdowns to effect plant changeovers by these three producers. Lincoln, Mercury and Ford will have radically restyled models on the assembly line early next year, introductions coming in the order listed. The new Ford line is not expected before April, numerous delays having been experienced in tooling.

Virtually nothing is heard of impending changes in Chrysler, Dodge, De Soto or Plymouth. It is a good bet, however, that these four will confine changes to moderate restyling, deferring major redesigns until next fall. Packard will follow its present new convertible with another larger one, and then will switch over closed models to the new design. Studebaker, generally credited with setting the pace on the styling trend of forthcoming models, will continue next year unchanged, except for the possibility an automatic transmission may be offered on its larger series.

Kaiser-Frazer is working on coupe and two-door sedan models of its present line, as well as a convertible—all due for introduction next year. K-F also has instituted work on a production layout for a new engine of its own design, scheduled for release in the not-too-distant future. Willys-Overland engineers are still tinkering with a 6-cylinder passenger car but its introduction will be delayed until enough materials can be diverted from jeeps, station wagons and trucks which now consume all the steel Willys can corral.

OBITUARY

CLINTON R. WYCKOFF, 72, president, treasurer and one of the founders of Atlas Steel Casting Co., Buffalo, died there Aug. 16, following a brief illness. Mr. Wyckoff attended Cornell University. He was also president of A. Wyckoff & Sons Co., Elmira, N. Y., treasurer and a director of the Frontier Iron Works, Buffalo, and a director of Wyckoff Drawn Steel Co., Pittsburgh.

° ° °

Barney Castor, 59, master mechanic, National Engineering Co., Chicago, died Sept. 3 at Minocqua, Wis. Mr. Castor had been with National Engineering Co., for 31 years and was active for many years in AFA exhibits and field service. Before entering the foundry equipment business with National Engineering he was associated with the old Caldwell & Son plant in Chicago.

° ° °

Fred P. Voss, 88, president, Voss Bros. Mfg. Co., Davenport, Iowa, died recently. Mr. Voss, with his late brothers, John A. and William H. Voss, organized the company in 1876. Mr. Voss also was one of the organizers of the Blackhawk Foundry Co., Davenport.

° °

N. L. Gansmann, 56, president, Original Enamel Range Co., Belleville, Ill., died Sept. 4, at his home in Swansea, a Belleville suburb. Mr. Gansmann was formerly president of the Supreme Foundry & Mfg. Co., and the old Richland Stove Co., in Belleville.

° ° °

Henry M. Reed, 66, chairman of the board of directors, American Radiator & Standard Sanitary Corp., Pittsburgh, died in Allegheny General Hospital, that city, following a long illness.

° ° °

Dr. William E. Wickenden, 64, who retired recently as president of the Case Institute of Technology, Cleveland, died Sept. 1, in Peterboro, N. H. Dr. Wickenden, a native of Toledo, O., was graduated from Denison University and from University of Wisconsin. He taught at the latter as well as at Massachusetts Institute of Technology, before joining American Telephone & Telegraph Co., of which he became assistant vice president in 1921. He was inaugurated president of Case in 1930.

° ° °

Arthur Blotevogel, 55, for 20 years a foreman at the Commonwealth Division of General Steel Castings Corp., Granite City, Ill., died Sept. 3, at Litchfield, Ill.

° ° °

William C. Bradley, chairman of the board, Columbus Iron Works Co., and Southern Plow Co., its subsidiary, Columbus, Ga., died July 26.

° ° °

Wendell F. Hebard, 63, president, W. F. Hebard & Co., manufacturers of industrial tractors, Chicago, died Sept. 4 in Evanston, Ill.

° ° °

Edward H. Stuckstede, 43, a partner in the St. Louis Bell Foundry Co., St. Louis, manufacturer of church bells, died there Sept. 4.

° ° °

T. Rice Davis, 70, retired managing director, Naugatuck, Conn., works of Eastern Malleable Iron Co., died Aug. 12.

° ° °

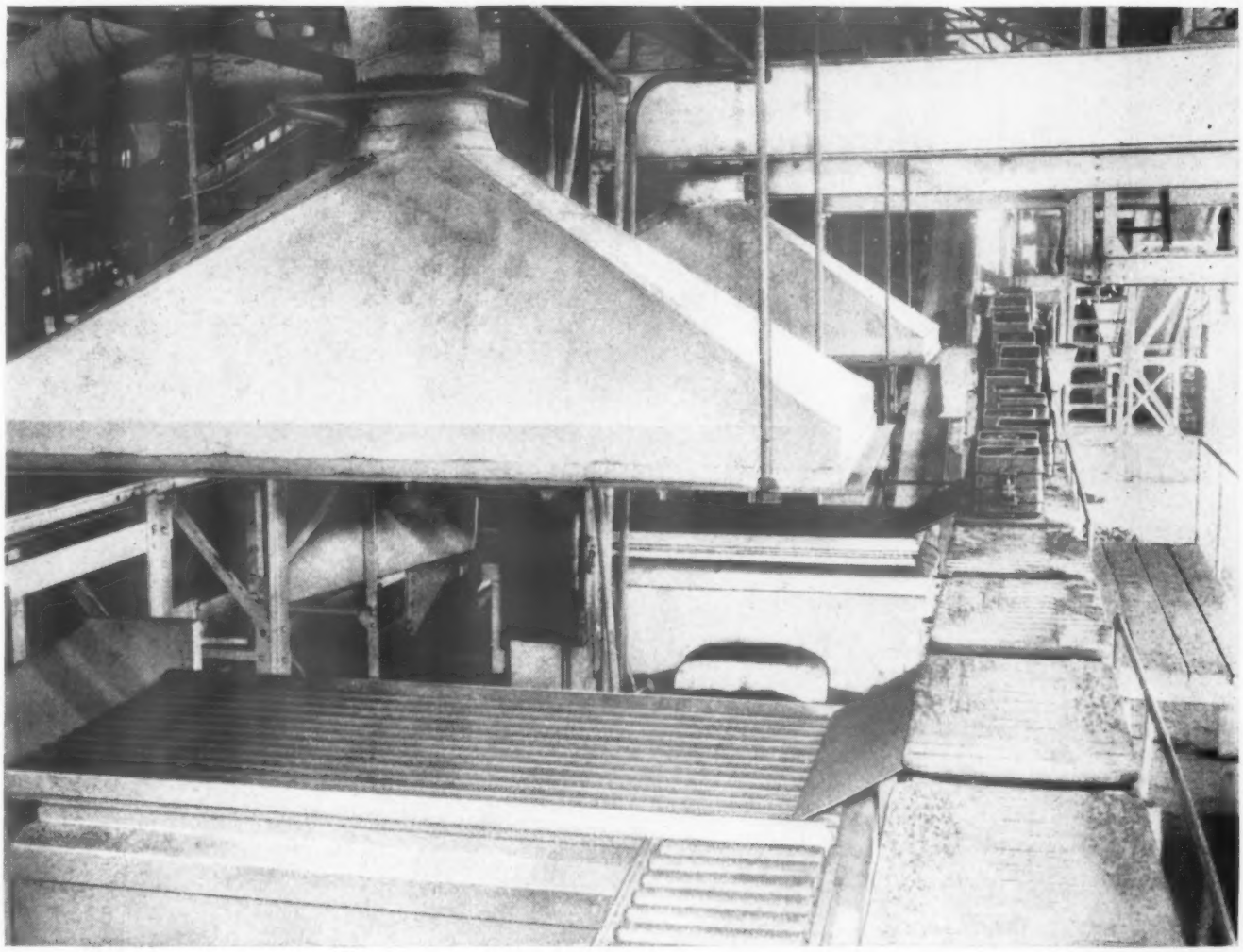
Luther E. Roby, president, Peoria Malleable Castings Co., Peoria, Ill., died July 30.

Foundry Training Course Is Offered

Industrial Metallurgy Institute Inc., 305 Kahler Bldg., 312 Third St., N. W., Canton 2, O., is offering a foundrymen's educational program. The course, begun Sept. 15, is designed to stimulate the interest of younger men in foundry work as a career, as well as give them a technical background from which they can adapt themselves to the practice of the particular foundry in which they are employed.

It approaches the problems of casting production from the standpoints of sand control, molding and coremaking, and physical metallurgy. For the presentation of this curriculum the institute employs its completely equipped laboratory. Co-operation of several local foundries in the procurement of patterns, sands, sand testing equipment and molding equipment has been obtained.

Classes meet for 3 hours one evening weekly, and the course requires 31 meeting. Cost of the training course is $125.55 plus $30 for laboratory fees and books.



NOW! Shake out castings right on your production line

Picture this new shakeout in your plant . . . *precision-timed* to a modern production line!

Imagine loaded flasks moving along your conveyor in a steady flow. Think of flasks moving with the security of proved mechanism—not with the uncertainty of gravity. They pass to the shakeout and continue to travel across at exactly the same rate of speed as the conveyor.

Sand is removed! Flasks and castings come clean without damage! They move to the next conveyor . . . and keep right on going!

All this is made possible by the new Robins Self-Discharging Floatex Shakeout. Here's streamlined production-line technique at work right in your own foundry!

The patented Robins mechanism vibrates with an elliptical motion. This not only produces effective shakeout vibration, but also makes flasks move steadily and positively forward.

This Self-Discharging Floatex Shakeout is the only unit that gives positive, horizontal flow. It is synchronized with the rate of speed of your foundry conveyor. And your flasks move at conveyor level.

So call a Robins engineer whenever you are looking for a new and better way to speed your foundry operation. Write today for complete information about the Robins Floatex Shakeout.

ROBINS CONVEYORS DIVISION . . . Hewitt-Robins Incorporated, Passaic, New Jersey

ROBINS
FLOATEX SHAKEOUTS

STATIONARY PORTABLE SELF-DISCHARGING

3 TYPES DESIGNED TO HELP YOU 6 WAYS:

1. Save Time
2. Reduce Labor
3. Help Sand Recovery
4. Cool Hot Sand
5. Minimize Flask Breakage
6. Improve Working Conditions

Foundry Developments

By EDWIN BREMER

ACCORDING to a report issued by British Intelligence Objectives Subcommittee, one German foundry firm proposed a novel scheme for producing steel. Procedure is to melt steel scrap in a cupola, discharge the molten stream onto a refractory channel, and blow hot air or oxygen-enriched air through it Metal stream is to be 3 to 4 in. thick, and the channel over which the metal flows about 10 ft long. Floor of the channel is to be silicon carbide brick spaced about 0.12-in. apart for admittance of air under pressure of about 2 psi at a temperature of 930° F or augmented with 28 per cent oxygen. It was claimed that the method would produce about 5½ tons of steel per hour.

° ° °

VOLUME production of transparent mirrors recently has been announced by Libbey-Owens-Ford Glass Co., Toledo, O. Functioning as a reflective surface when seen from one side and simultaneously as a window when viewed from the other, the transparent mirror provides numerous applications in commercial enterprises, public institutions, and homes. Transparent mirrors can be installed in doors of offices permitting the occupants to examine callers without revealing their own presence. Other possible applications include panels for doors between kitchens and dining rooms to permit those serving from the kitchen to watch the progress of the meal, glazing of shower stalls, observation windows in clinics and wards of hospitals, etc. Key to the transparent mirror's performance is the almost incredible thinness of the chromium alloy film on the surface. It is four ten-millionths of an inch thick, and while constituting an effective reflecting surface, it also permits the passage of light.

° ° °

INVESTIGATION of phenolic-resin binders in sand cores for ferrous metal castings, recently completed by Battelle Memorial Institute, indicates several interesting features of that type of binder. It is pointed out that such binders give high strengths; they are fast curing especially in thick sections, and do not have much tendency to overcure at optimum baking schedules; gas evolution is low, and the pouring operation does not develop obnoxious gases and smoke. In actual foundry trials it was found that the odor of phenol-formaldehyde resins was objectionable at first, but by the third day workers were so accustomed to the odor that objection ceased. The work was developed under the sponsorship of Resinous Products & Chemical Co.

° ° °

APPROXIMATELY 2500 reports of research on wartime technical problems are now available, according to a bibliography and index published recently by the Office of TechnicalServices, Department of Commerce, Washington 25. Volume is divided into three parts of which the first cites author, title and price of photostat and microfilm copies of report. It also refers to page number of the *Bibliography of Scientific and Industrial Reports* where an abstract may be found. Part II is a cross reference list correlating OSRD code number and OTS number for each report. Part III is an author and subject index to Part I. Orders for book (PB-78000; OSRD Reports-Bibliography and Index, 109 pages) should be addressed to OTS. Price is 75 cents.

° ° °

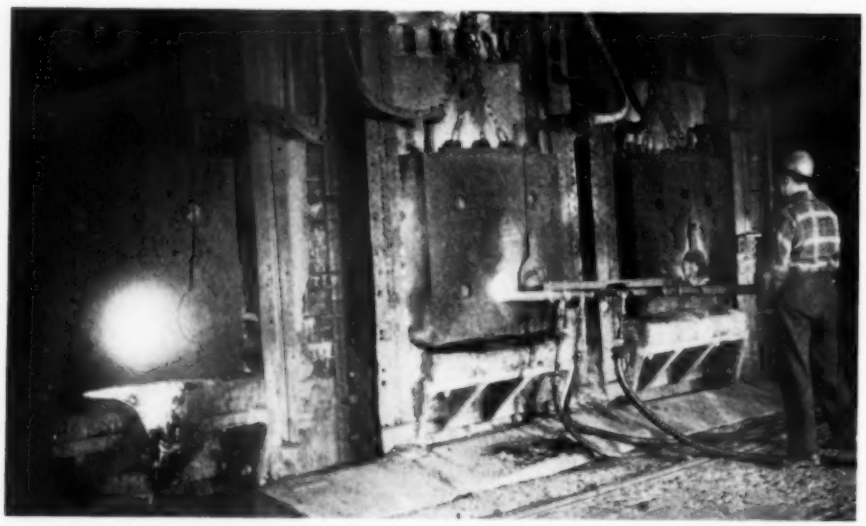
DESCRIBING the "Precision Casting of High-melting Point Alloys Containing Nickel" at the annual meeting of the Institute of British Foundrymen, Evans, Cotton and Thexton state that the mounted wax patterns are sprayed with a mixture composed of 100 g zircon flour (200 mesh) 17 cc ethyl silicate stock solution, 29 cc industrial methylated spirit, and 5 cc hydrochloric acid. Ethyl silicate stock solution is composed of 75 per cent by volume condensed ethyl silicates, 7 per cent water, and 18 per cent ethyl alcohol. Hydrochloric acid is 10 per cent by volume of 1.16 sp gr in methylated spirit. Investment mixture employed contains 3000 g silimanite (30-mesh grade), 375 g sillimanite (FF grade), 281 cc ethyl silicate stock solution, 827 g industrial methylated spirit, and 17 cc hydrochloric acid (1.16 sp gr).

° ° °

ACCORDING to recent reports ground bark from the Douglas fir has been tried out experimentally as a foundry parting material and a core binder. Material is called "Silvacon 472" and is produced by Weyerhaeuser Timber Co., Tacoma, Wash.

° ° °

GROWING interest in the newer forms of mineral wool insulation has resulted in the government issuing purchasing specifications for the Army, Navy, Maritime Commission and other bureaus. Available from the Superintendent of Documents, Washington 25, for 5 cents a copy, Federal Specifications HH-1-564 defines block and board insulation. Four classes of mineral wool compacts are set up by temperature range; up to 225° F, up to 500° F, up to 1000° F, and up to 1300° F. Breaking strengths must exceed 8 lb per inch of thickness; linear shrinkage shall not exceed 2 per cent; water absorption shall not be greater than 2 per cent by weight; density shall not exceed 20 lb per cu ft for the 500° F material nor 25 lb per cu ft for the three higher temperature materials. Maximum thermal conductivities in Btu per hr per sq ft per °F shall be as follows for the indicated mean temperatures—0.35 at 100° F; 0.55 at 300° F; 0.67 at 550° F and 0.80 at 800° F.



Using Linde Air Products Co. oxygen jet device for melting steel scrap in open hearth. Photo courtesy Jones & Laughlin Steel Corp.

use "NATIONAL" GRAPHITE RISER RODS

IF YOU are now using a carbonaceous "pipe eliminator" on the riser metal of your steel castings, you can obtain greater control at lower cost by switching to "National" graphite riser rods.

Graphite rods give you this better control of carbon addition in the riser metal for the following reasons:

1. **Graphite rods are put in place prior to pouring.**
2. **Quantity of graphite used can be measured.**
3. **By selective location of the graphite rods, atmospheric rupture is assured on the internal riser metal.**

Steel foundries that have tested "National" graphite rods on open, blind, and semiblind risers report a number of operating advantages. Riser height may be reduced without risking either carbon pick-up or porosity in the casting itself. The shrinkage void is flat-bottomed and stays in the riser. This means that riser designs may be simplified and cost of castings materially reduced.

For more information on "National" graphite riser rods, write to National Carbon Company, Inc., Dept. FA.

NATIONAL CARBON COMPANY, INC.
Unit of Union Carbide and Carbon Corporation
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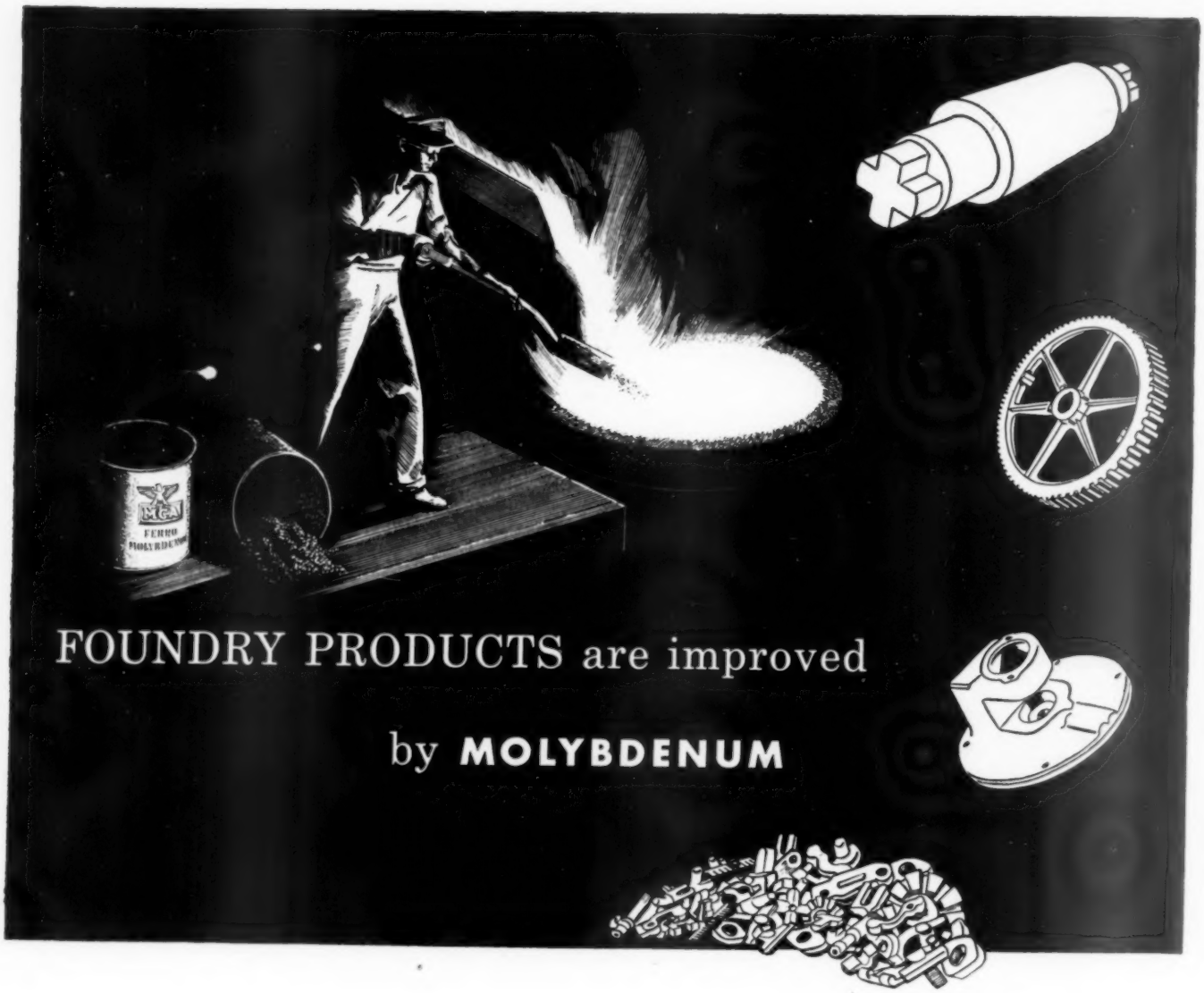
30 East 42nd Street, New York 17, N. Y.
Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

The term "National" is a trade-mark of National Carbon Company, Inc.



Where high strength is required, and especially strength at high temperatures . . .

Where uniform strength in light and heavy sections is important . . .

And where economy of weight, dimension, or basic materials is a ruling consideration . . .

Molybdenum is entering more and more into the composition of modern castings.

A wide range of physical properties is obtainable by heat treatment.

Advanced formulas and foundry procedures make a little Molybdenum go a long way.

The Molybdenum Corporation, as a supplier of Molybdenum, Tungsten and Boron, is glad to be consulted by any user of these products.

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AMERICAN Production, American Distribution, American Control, Completely Integrated.

Offices: Pittsburgh, New York, Chicago, Cleveland, Detroit, Los Angeles, San Francisco, Seattle.

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Works: Washington, Pa.; York, Pa.

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Visit Space 733 at National Metal Show

MOLYBDENUM CORPORATION OF AMERICA

GRANT BUILDING PITTSBURGH, PA.

MCA

FOUNDRY STATISTICS

Index of Foundry Equipment Orders

(Net Orders Closed)

	New Equipment	Repairs	Total Sales
1946			
July	444.8	481.1	453.4
Aug.	555.5	484.1	538.7
Sept.	415.4	433.5	424.4
Oct.	407.1	672.0	469.2
Nov.	421.0	661.5	477.4
Dec.	379.0	600.3	430.9
1947			
Jan.	466.9	665.0	513.4
Feb.	472.5	682.9	521.9
Mar.	532.3	709.5	573.8
Apr.	445.9	727.9	512.1
May	525.9	623.0	548.6
June	658.9	620.7	649.9
July	426.1	565.3	458.7

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufacturers Association.

Estimated Number of Foundry Wage Earners

Type Foundry	June 1947	May 1947	June 1946
Gray Iron	85,300	85,700	78,200
Malleable Iron	26,300	25,800	23,700
Steel	48,600	49,500	50,800

Source: Bureau of Labor Statistics.

Castings Production

In Philadelphia Federal Reserve District

July, 1947

Type Foundry	Percentage Change From: June, 1947	July, 1946
Gray Iron	— 5.0	— 4.7
Malleable Iron	+ 8.4	— 21.0
Steel	—26.3	— 31.9
Nonferrous	—51.2	— 35.7

Source: University of Pennsylvania

Average Earnings and Hours of Foundry Workers

Type Foundry	Average Weekly Earnings			Average Weekly Hours		
	May 1947	Apr. 1947	Mar. 1947	May 1947	Apr. 1947	Mar. 1947
Gray Iron	56.34	54.57	54.49	42.6	42.0	42.3
Malleable Iron	54.35	53.52	52.72	41.0	41.0	40.5
Steel	54.33	53.01	52.23	40.5	40.4	40.0

Source: Bureau of Labor Statistics

—SHIPMENTS OF CASTINGS—

(Reported by Bureau of the Census)

Gray Iron Castings

(Net tons)

	Shipments Total	Shipments For Sale	Unfilled °Orders
1946			
Feb.	571,894	383,315	2,181,809
Mar.	820,111	517,992	2,285,082
Apr.	885,701	542,649	2,430,079
May	782,850	465,038	2,531,095
June	757,268	442,473	2,640,430
July	840,004	487,458	2,708,385
Aug.	973,232	567,164	2,814,430
Sept.	937,401	540,649	2,897,105
Oct.	1,077,838	626,273	2,952,705
Nov.	987,069	561,626	2,940,199
Dec.	909,195	514,415	2,979,658
TOTAL	10,269,657	6,102,246	.....
1947			
Jan.	1,077,820	632,789	3,021,141
Feb.	1,009,970	583,252	2,986,741
Mar.	1,089,828	633,844	2,979,326
Apr.	1,097,150	636,708	2,907,694
May	1,097,307	636,013	2,782,706
June	1,038,356	596,874	2,710,854

° For sale only.

Steel Castings

(Net tons)

	Shipments Total	Shipments For Sale	Unfilled °Orders
1946			
Feb.	60,604	45,687	387,222
Mar.	104,483	80,851	406,401
Apr.	146,608	107,313	384,653
May	130,844	94,761	374,168
June	121,522	89,533	354,367
July	117,528	82,975	356,799
Aug.	129,666	94,063	373,745
Sept.	126,471	90,567	380,589
Oct.	137,304	98,265	384,082
Nov	130,606	93,878	372,058
Dec.	123,907	88,136	362,787
TOTAL	1,432,049	1,043,358	.....
1947			
Jan.	139,029	101,140	365,476
Feb.	125,612	92,822	421,405
Mar.	134,909	99,701	434,865
Apr.	144,175	106,127	427,554
May	140,874	103,779	443,225
June	139,031	103,888	445,475
July	116,956	85,014	473,923

° For sale only.

Malleable Iron Castings

(Net tons)

	Shipments Total	Shipments For Sale	Unfilled °Orders
1946			
Feb.	40,155	29,326	248,644
Mar.	50,235	33,978	263,227
Apr.	65,010	36,298	267,713
May	62,598	34,975	271,925
June	61,650	35,468	275,845
July	64,446	38,021	271,981
Aug.	67,903	41,345	272,440
Sept.	69,507	39,631	277,309
Oct.	79,207	46,477	280,972
Nov.	68,987	39,328	278,446
Dec.	68,314	39,327	267,661
TOTAL	752,028	452,355	.....
1947			
Jan.	75,898	42,414	259,764
Feb.	74,716	41,684	274,018
Mar.	76,614	43,488	280,724
Apr.	81,890	47,303	275,415
May	75,478	42,294	262,117
June	78,524	45,291	248,798
July	64,162	40,733	234,656

° For sale only.

Aluminum Castings

(Thousands of pounds)

	Shipments Total	Shipments Sand	Shipments Perm. Mold	Unfilled °Orders
1946				
Feb.	23,231	11,613	7,866	94,858
Mar.	26,661	10,792	11,305	97,013
Apr.	27,692	11,562	11,010	100,267
May	29,176	11 834	12 228	117,710
June	28,496	11,674	11,767	118,747
July	28,828	10,706	12,213	124,457
Aug.	33,845	12,721	14,309	133,510
Sept.	32,003	12,445	13,045	136,237
Oct.	39,917	14,559	17,311	144,276
Nov.	35,635	13,192	15,440	138,270
Dec.	34,754	12,827	14,586	137,198
TOTAL	353,809	143,481	151,211	.....
1947				
Jan.	39,438	14,030	16,902	131,368
Feb.	35,904	12,936	15,148	128,999
Mar.	40,135	13,791	17,509	121,038
Apr.	39,438	13,633	16,605	112,926
May	37,400	13,646	14,514	112,548
June	32,986	11,775	13,105	102,758

° For sale only.

Copper-base Alloy Castings

(Thousands of pounds)

	Shipments Total	Shipments Sand	Shipments Perm. Mold	Unfilled °Orders
1946				
Feb.	60,856	56,992	1,713	72,736
Mar.	74,971	66,076	2,353	70,622
Apr.	77,919	71,105	2,390	71,108
May	76,054	70,748	2,453	76,792
June	70,910	66,378	1,755	78,449
July	66,695	62,369	2,339	78,018
Aug.	77,733	72,158	2,376	77,538
Sept.	76,835	71,545	2,415	84,183
Oct.	89,148	83,610	2,559	80,770
Nov.	77,605	72,671	2,159	79,126
Dec.	77,961	73,278	2,122	80,445
TOTAL	898,952	832,037	26,520	.....
1947†				
Jan.	85,783	80,524	2,164	78,874
Feb.	78,729	73,863	2,046	76,016
Mar.	83,195	77,113	2,623	74,422
Apr.	84,196	78,760	2,253	69,392
May	90,054	81,851	4,732	73,550
June	84,604	77,402	3,829	67,119

° For sale only.

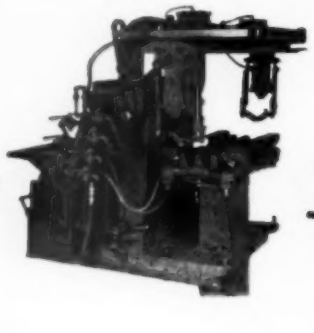
† 1947 figures include copper and copper-base alloy castings.

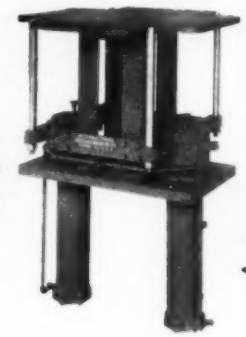
Magnesium Castings

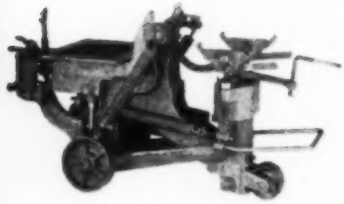
(Thousands of pounds)

	Shipments Total	Shipments Sand	Shipments Perm. Mold	Unfilled °Orders
1946				
Feb.	438	366	35	3,338
Mar.	594	525	33	3,484
Apr.	570	465	36	3,297
May	661	587	45	3,778
June	717	623	46	4,063
July	628	477	53	3,986
Aug.	694	568	56	4,234
Sept.	811	676	61	4,096
Oct.	921	733	73	4,219
Nov	716	574	41	4,294
Dec	717	635	28	4,599
TOTAL	7,865	6,578	523	....
1947				
Jan.	809	723	40	4,480
Feb.	707	605	69	3,776
Mar.	677	593	45	3,276
Apr.	627	526	78	3,245
May	628	481	104	3,297
June	613	476	93	3,183

° For sale only.

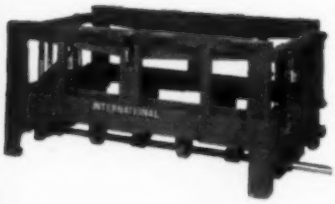


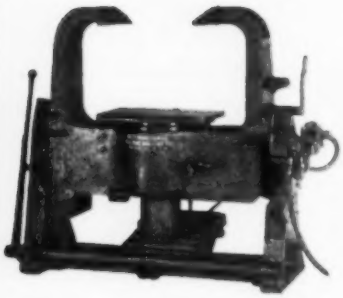




INTERNATIONAL MOLDING MACHINES

For Castings





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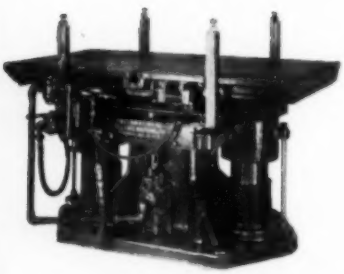
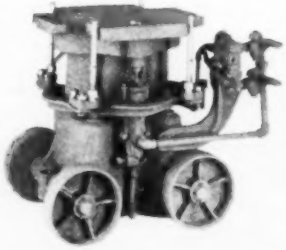
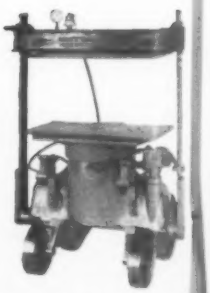
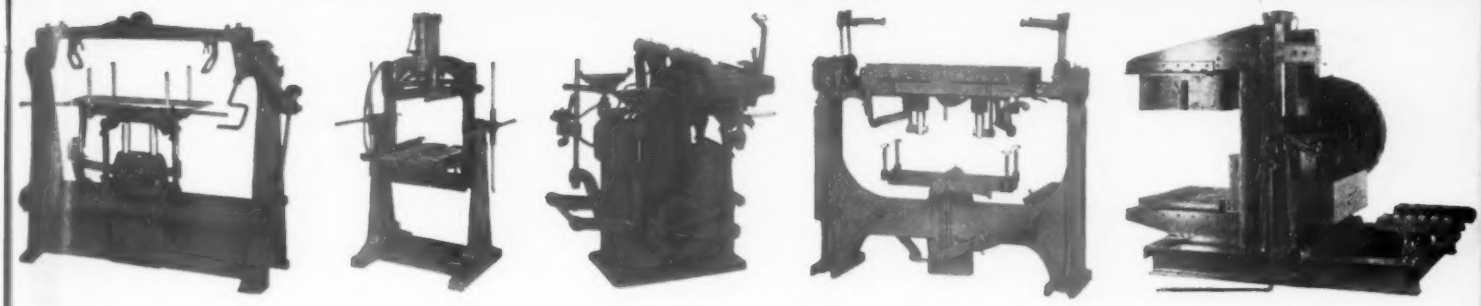


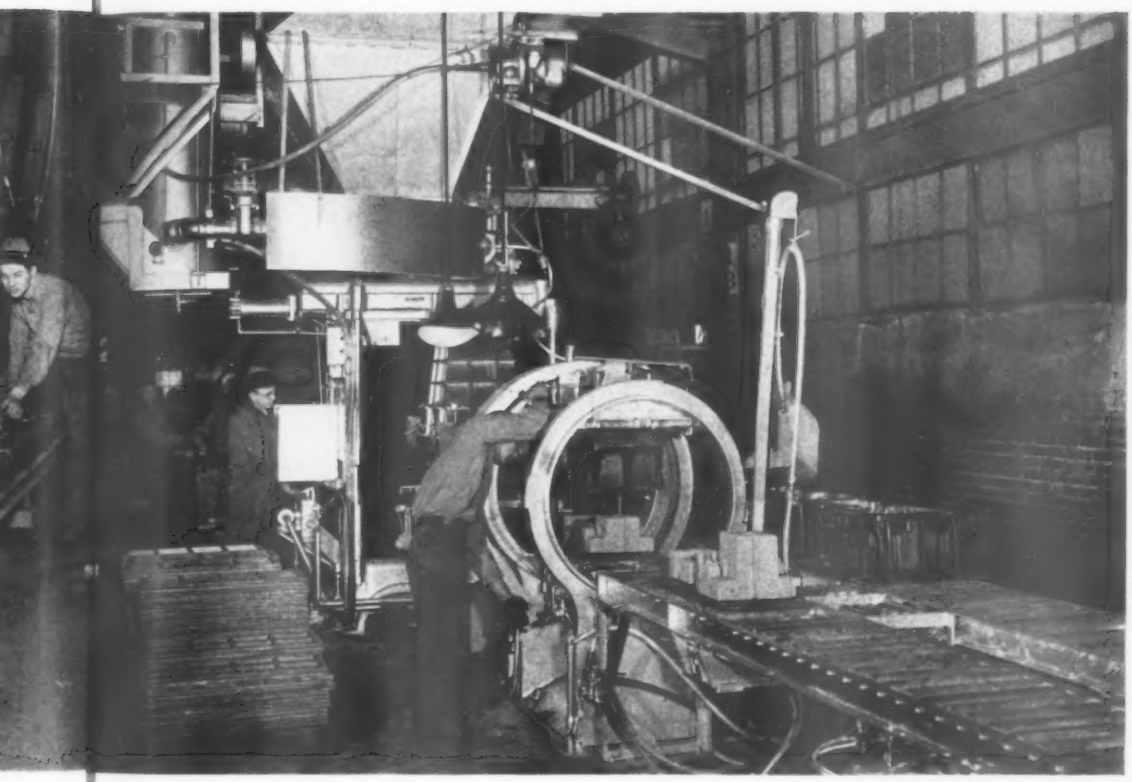


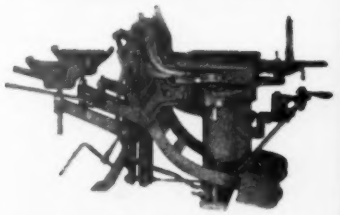


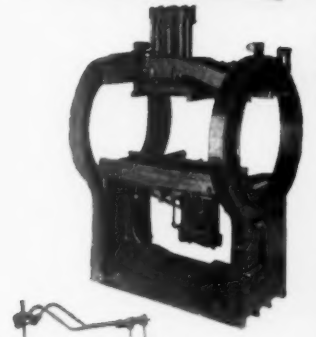


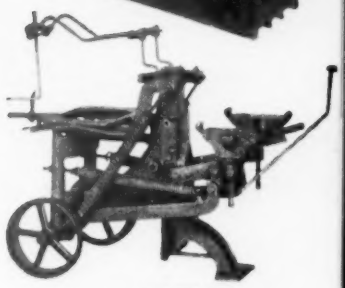
INTERNATIONAL MOLDING MACHINES

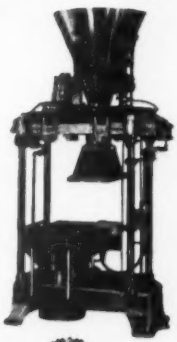
For Cores











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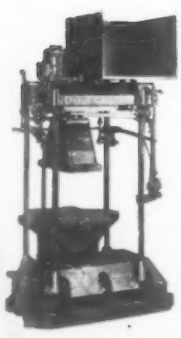
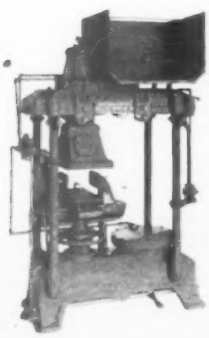
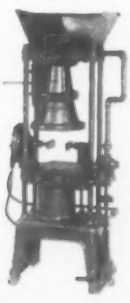
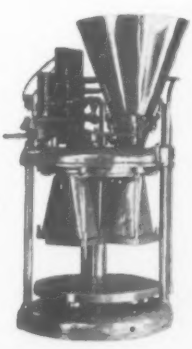
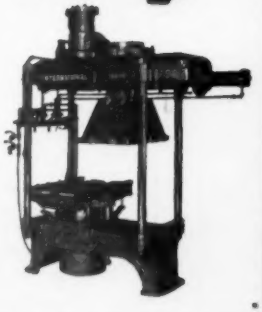










MAN-TO-MAN
on the Molder's Bench

"The Wrong Side of the Track"

By RALPH L. LEE

CAME near losing my temper the other day, while riding cross country with a master mechanic friend of mine. We talked like Dutch uncles during most of our three-hour ride, seeing eye to eye on almost every phase of shop practice under discussion, until, when more to himself than to me, he said, "What a pity the foundry has to stand still while every other department of industry moves ahead with leaps and bounds."

"What do you mean, stand still," I said, raising my voice for the first time on the trip. Snapping back like that after one agreement after another must have given him quite a jolt, for he looked as though everyone took it for granted that the foundry was in a rut.

"Ralph," he said, "I'd be willing to bet that if we turned our tool men loose on the foundry you wouldn't know the old place inside of a month."

"Ollie, I want to ask you something —when's the last time you condescended to spend just one measely day browsing around the foundry with your mind wide open?"

"Why Ralph," he said, "now let's see—by golly, now that I come to think of it—it's been, but say, what's that got to do with it?"

"Ollie, old timer it's got everything to do with it, I know from my many foundry visits, from talking to foundry people all over the country and doing a little molding myself, that the foundry isn't standing still by a darn sight. In fact, I think foundry people have spoiled some of your cookies."

"What do you mean spoiled?"

"Knowing what side their bread is buttered on," I answered "they have taken anything and everything you guys saw fit to hand them and have literally had to pull rabbits out of hats for you. Don't forget *SAND* Ollie. As crummy as it is, it still remains the only thing we can get which will stand up under the heat it takes to melt the metals you manufacturing people insist upon.

"Tolerances are being held in some cases today—and on sand mind you, —that the machine shop could not have maintained a few years ago. I'm not even mentioning the cantankerousness and unpredictability of directional solidification, the hydraulics of molten metal, crystallization, capillary attraction, surface tension and all that there stuff."

Being moved by the sound of my own voice, I went on waxing even more eloquent. "In spite of the troubles you guys have now and then with *our* castings, I think that the first step you (tool, machine and production folks) must take before you are qualified to view the foundry with alarm is to knock off for at least one day and find out first hand what is really going on in the foundry."

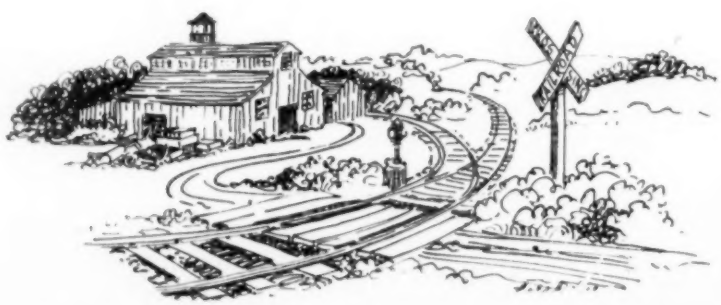
We didn't quarrel because neither he nor I enjoy a squabble. Before we got to the end of our trip we both had to admit for some reason or other the foundry to most manufacturing people is a little smoky, sparky, hot and dusty world all by itself with very little sex appeal.

I know for a fact that many, yes the majority, of my engineering, tooling and production friends instinctively feel like passing all foundries on the other side of the street and never go into one if they can possibly avoid it. In spite of the fact that everything and anything anyone can mention has got to start with a casting, the foundry industry is small in comparison with its importance and the industries it serves.

It strikes me that we foundry people have got to get ourselves over onto the other side of the tracks —we have got to get rid of our industrial B. O. I think we can if we set our minds to it. Let's make a list of the key people on the staffs of our customers and connive and scheme to get them into the foundry, no matter what or how long it takes. When we get them into our clutches let's teach them a few simple words of foundry Greek, hand them a few keys to the mysteries of molten metal and inoculate them with a touch of the old sand virus.

I'd be willing to bet that when these folks find themselves unconsciously talking foundry lingo and thinking a few foundry thoughts they will begin to grasp the idea that foundry people aren't such a bad lot after all and have not been asleep at the switch by a darn sight.

In spite of the fact that sand is clean dirt (my grandpappy died putting up a real he-floor of molds close onto 70) we might want to clean things up a bit and lay out a pattern for the visits. When they do begin dropping in on us without having to, just for foundry gossip, we might then let them try their hand at engineering us a bit. Who can tell, something good may come of it.



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CORE OILS
SOCONY-VACUUM

COREROOM IS MODEL OF EFFICIENCY

(*Continued from page* 71)

places the boards on storage racks in the vicinity. This is the first step in arranging duplicate cores in similar groups. The long conveyor belt delivers a miscellaneous assortment of cores to the oven. As mentioned elsewhere the belt serves the coremaking benches on either side. At the storage racks the cores are removed from the driers, and the driers are placed on a long gravity conveyor. At various points the driers are removed and placed on racks in the general vicinity of the coremaking stations where they are needed.

When the cores arrive at the lower floor, they are placed on storage racks, and then fed steadily via conveyor to the inspection benches, where a corps of sharp-eyed women operators examine them closely for possible defects in shape, size or dimensions. Particular attention is paid to seeing that all vent passages are free and open. So far as possible all cores are designed for production as one-piece units. Where this is impossible the core may be made and dried in two or more parts. At the assembling and inspection benches these parts are joined to form the complete unit that goes into the mold.

From the benches the cores, loaded on small boards, are moved on gravity conveyor to a group of storage racks. On the way they are viewed by a checker who keeps a record, and who tacks a small card to each board showing its destination. This is for the guidance of the attendants who remove the cores from the conveyor and place them on the racks conveniently located on both sides of the conveyor. The conveyor in turn operates in the center of a wide gangway.

This generosity of space is one of the most noticeable features throughout the entire building and may have been influenced to some extent by the necessarily crowded condition of the original coreroom, also by the fact that in the foundry building, 1000 ft in length, a 15-ft gangway in the center extends from one end of the building to the other end. The molding floors extend from the central gangway to each side wall of the building. The three cupolas set up close to one side of, and with spouts extending into the gangway, melt the iron required for all the molds on the floor. The cupolas are spaced in such a manner that the metal from each one is distributed to molds on a floor area 120 x 300 ft. More extended reference to the foundry proper lies outside the scope of the present description, which is concerned specifically with the new coremaking department that is functioning so satisfactorily.

Each shelf on the extensive group of storage racks on the ground floor is marked with the name of a customer whose order for castings is going through the foundry. Cores from the conveyor are lifted and placed on the racks in accordance with the name on the rack, and the name on the small card tacked to the board. With a supply at least one day ahead of demand, the cores are taken from the racks and placed on 3 x 5-ft double deck wood platforms suspended from a monorail which carries them into the foundry where they are distributed to the various molding floors.

Visit Canadian Experimental Foundry

ALUMINUM and magnesium division of the American Foundrymen's Association some time ago established a special committee on centrifugal casting of light alloys. This committee studied the commercial use of centrifugal casting in aluminum and magnesium foundries.

Results of a co-operative project in this field, carried out in American and Canadian foundries, were promising. At present a new research project is being sponsored by the committee at the experimental foundry of the Canadian Bureau of Mines, Ottawa, Ontario.

Members of the committee are shown visiting the experimental foundry. Left to right, are: J. A. Fulwider, Allison-Bedford Foundry; H. J. Rowe, Aluminum Co. of America; G. M. Young and J. Laucks, Aluminum Co. of Canada; Walter Bonsack, National Smelting Co.; J. W. Meier, Canadian Bureau of Mines; David Basch, Almin. Ltd., committee chairman; Sam Tour, Sam Tour & Co. Inc.; H. R. Youngkrantz, Apex Smelting Co.; M. J. Brooks, Dow Chemical Co.; R. J. Traill, chief, Mineral Dressing & Metallurgy Division, Canadian Bureau of Mines.

X-RAY INSPECTION PROMOTES CASTING QUALITY CONTROL

(*Continued on page* 96)

shifting of a gate on crankshaft from the bearing to the arm, which eliminated the porosity that had been the principal source of difficulty in getting into production on this particular product.

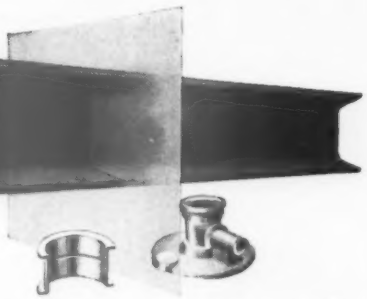
A classic case of re-designing the product to suit the process (Fig. 6) is found in the jack base—part of Auto Specialties' own line of products.

Here, porosity persistently occurred in a spot near the gate, and no amount of gate shifting seemed to help. Finally, it was proved that this problem was not due to gating at all, but to the difficulty experienced by the metal inside the mold in flowing through a narrow section. By creating a small channel or web connecting two protruding sections of the casting, this trouble was eliminated entirely. An effort was then made to weld those bases of the old design in order to eliminate the porosity. The radiographs showed, however, that welding was not quite good enough to salvage these items. They were scrapped.

Radiography has made it possible to execute radical changes in crankshaft design—such as the casting of crankshafts with hollows partially or completely through the center shaft and/or the bearing area. (Figs. 7-8). Only by the closest control and observation of results has it been possible to develop proper molding and pouring techniques for this purpose. In one case, due to these reductions in metal content, an unfinished cast crankshaft for a certain automobile

(*Continued on page* 133)

FOR DEPENDABILITY



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Metal Fluoborate Solutions
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Nitric Acid
Potash Alum
Potassium Cyanide
Sodium Fluoride
Sodium Metasilicate
Stannous Chloride
Sulfuric Acid
Tetrasodium Pyrophosphate
Trisodium Phosphate

Rimming Steel Manufacture

Sodium Fluoride

Steel Manufacture

Sodium Bisulfite, Anhydrous
Sodium Sulfite, Anhydrous
Sulfur
Iron Sulfide

Descaling

Glauber's Salt
Sulfuric Acid

Acetic Acid
Hydrofluoric Acid
Muriatic Acid (Hydrochloric)
Nitric Acid
Sulfuric Acid
Nitre Cake
Sodium Fluoride
Sodium Bifluoride

Casting

Ammonium Fluoborate
Potassium Fluoborate
Sodium Fluoborate

Barium Fluoride
Sodium Fluoride
Potassium Fluoride
Potassium Cyanide

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Acetic Acid
Perchloric Acid
Sulfuric Acid
Hydrofluoric Acid

Bright Dipping

Hydrofluoric Acid
Nitric Acid
Sulfuric Acid
Muriatic Acid (Hydrochloric)

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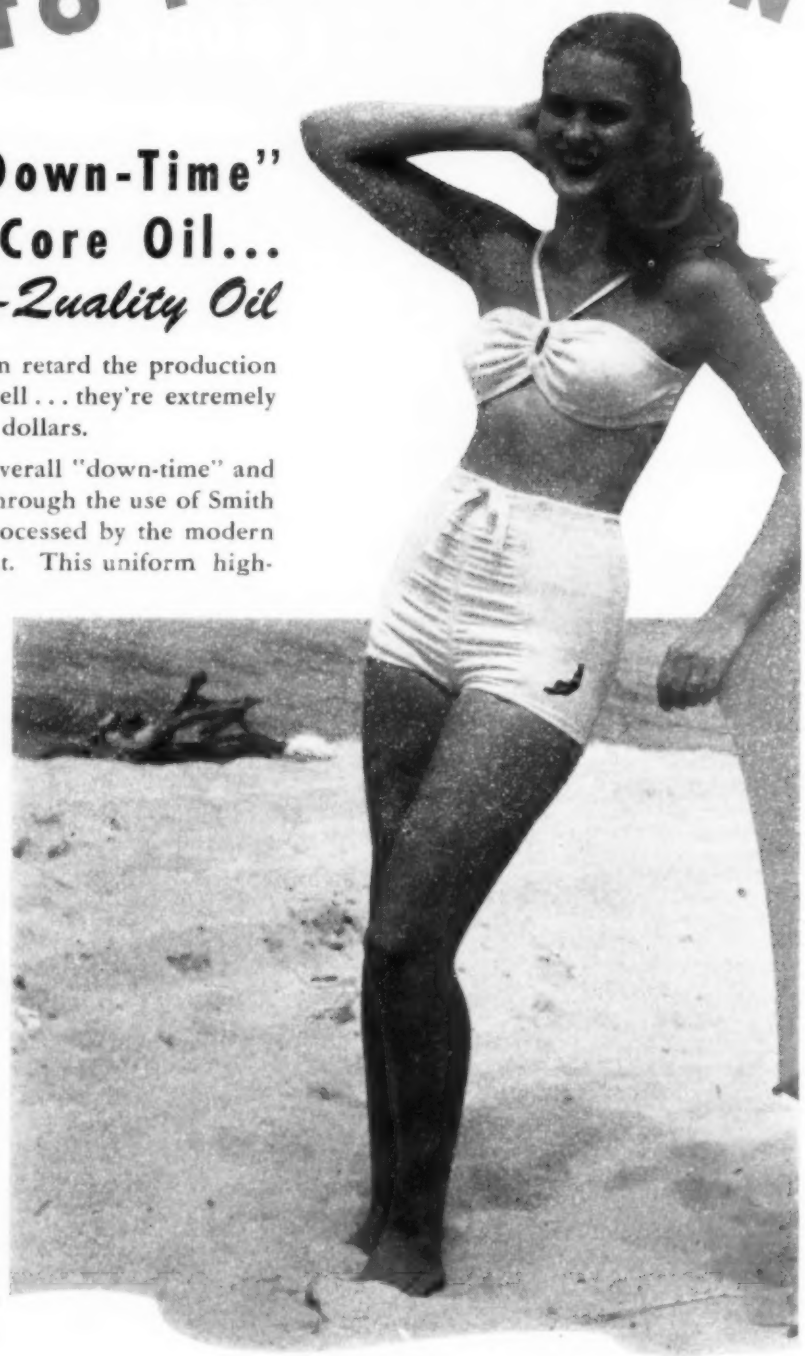

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CORE WASH ROD DIP LIQUID PARTING

SMITH OIL & REFINING CO.

INDUSTRIAL OILS DIVISION . . . ROCKFORD, ILLINOIS

(*Continued from page* 130)

weighed 1 lb less than did a finished shaft produced by another process which did not permit incorporation of the hollows.

The use of x-ray has enabled foundrymen to invade many fields and attempt many changes in product design that they would not have dared to attempt without it. Changes in design are easy to visualize. Designers may even be able to predict theoretically in advance that the new shape will withstand all the necessary strain. But one of the most difficult things to determine is how the new shape can be successfully cast without a prohibitive proportion of excess metal to feed it, and without developing hot tears, shrink, porosity and blows in strategic locations.

Radiographic findings often reach as far back as the melt. In one case (Fig. 9) it was shown that the cause of pinholes was improper deoxidation of the melt due to addition of insufficient aluminum. In another case, that the core was too hard, resulting in hot tears or trapped gas. In still another, that the core was soft and metal had burned in, necessitating too much grinding.

In one instance, by correlating their strength tests with radiographic findings, the firm has been able to produce one of its products from malleable iron instead of steel, without sacrifice of durability or soundness of the casting.

One auto manufacturer who needed an unusually small crankshaft, found that he could have it cast, after rapid radiographic studies proved the soundness of the pilot lot. This shaft later withstood 50 hours of testing at 7000 rpm.

Radiographic Technic—As was mentioned previously, most crankshafts are x-rayed at a 10-ft target-to-film distance; jack parts and other smaller items are sometimes done at shorter distance. Between .090 and .100-in of lead sheet is used as a filter for soft x-ray between the product and the film, and .010-in. of lead sheet is placed behind the film to absorb scattered radiation, thus increasing the sharpness of the image. Fine-grain film is used. A large ¾-in. sheet of lead serves as a "platform" on which all work is done. This reduces back-scatter to a minimum. Usual exposure time for a group of crankshafts is 6 to 8 minutes.

To provide complete protection for personnel, the x-ray equipment is placed in a room 25 ft wide, 45 ft long and 35 ft high, with the three walls 18 in. thick and the fourth wall (which faces the control room and office) 24 in. thick. This thickness extends to a height of 18 ft, then drops back to 10 in. The entire building is of concrete and is heated by radiant pipes in the floor. A large electrically-controlled concrete door permits entry into and exit of large apparatus from the x-ray room.

An ingenious crane mechanism is provided which permits the x-ray unit to be manipulated over a length of 38 ft, a lateral distance of 21 ft and a vertical travel of 18 ft.

Allowing for 8-minute exposures, and 8 minutes to make a setup for six crankshafts, Auto Specialties can examine 24 crankshafts per hour, which is more than ample at present. This is a maximum figure which is not always necessary to attain, particularly after a pilot lot has been studied and only spot checks need be made on subsequent lots.

Plans are now under way to increase operations from two shifts to three, as soon as personnel is available, and a plant for hydraulic jacks and Lambert disc bracks has recently been completed at Hartford, Mich. Average production

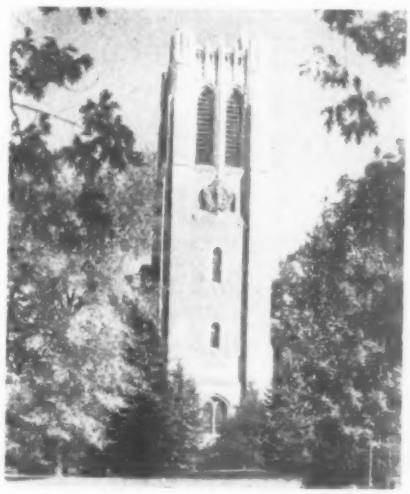
(*Concluded on page* 136)

MICHIGAN CONFERENCE

To Be Held Oct. 31, Nov. 1

MICHIGAN STATE COLLEGE, in co-operation with the four Michigan Chapters of the American Foundrymen's Association, will conduct its annual foundry conference at the East Lansing school, Friday and Saturday, Oct. 31 and Nov. 1. A comprehensive program of papers and round-table discussions has been arranged by the conference committee under the chairmanship of C. C. Sigerfoos of Michigan State College.

The various sessions, which will extend through all of Friday and Saturday morning, will be held in the R. E. Olds Hall of Engineering. In addition to the technical program as listed here, the school's engineering laboratories and shops will be open for inspection, and several men of the engineering staff will be available as hosts.



Beaumont Tower at Michigan State College, East Lansing, Mich.

Conference visitors are asked to make their hotel reservations direct with one of the following Lansing hotels: Olds, Porter or Roosevelt.

Other members of the committee in charge of conference arrangements include: F. S. Brewster, Harry W. Dietert Co., Detroit; M. V. Chamberlin, Dow Chemical Co., Bay City; Charles Locke, West Michigan Steel Foundry Co., Muskegon; Harold Myers, Sealed Power Corp., Muskegon; R. G. McElwee, Vanadium Corp. of America, Detroit; E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit; J. F. Coghlin Jr., Albion Malleable Iron Co., Albion; L. G. Miller, H. L. Womochel and N. C. McClure, Michigan State College.

The complete program follows:

Friday, Oct. 31

Chairman: A. H. Allen, Detroit Editor, THE FOUNDRY.

8:30-9:30 a.m.—Registration.

9:50 a.m.—"Address of welcome" by college representative.

10 a.m.—"Foundry Training Programs," by A. W. Gregg, executive engineer, Whiting Corp., Harvey, Ill.

11 a.m.—"Work Measurement and Wage Incentives," by C. H. Pesterfield and J. M. Apple, Michigan State College

12:30 p.m.—Luncheon. Chairman: H. B. Dirks, dean of engineering, Michigan State College. "The Veteran Student Looks at Jobs and Employers," by C. J. Freund, dean of engineering, University of Detroit.

2:30 p.m.—Round-table discussion on gray and malleable iron. Chairman: W. B. McFerrin, Electro Metallurgical Co., Detroit. General topic: "Operating the Cupola Under Material Difficulties." Discussion leader: R. G. McElwee, manager, Iron Foundry Division, Vanadium Corp. of America, Detroit.

2:30 p.m.—Round-table discussion on steel. Chairman: Charles Locke, general superintendent, West Michigan Steel Foundry Co., Muskegon, Mich. General topic: "Heading and Feeding of Steel Castings." Discussion leader: E. C. Troy, vice president, Dodge Steel Castings Co., Philadelphia.

3:30 p.m.—Chairman: A. J. Edgar, works manager, Benton Harbor Malleable Industries, Benton Harbor, Mich. "Mechanization in the Foundry," by W. R. Jennings, general foundry superintendent, John Deere Tractor Co., Waterloo, Iowa.

4:30 p.m.—"Testing the Scrubbing Tendencies of Molding Sands," by Wayne Edwards and Lionel Washington, students, and C. C. Sigerfoos, Michigan State College.

Friday evening—Dinner and entertainment.

Saturday, Nov. 1.

9 a.m.—"Westonite in Foundry Sands," by T. W. Curry, plant metallurgist, Lynchburg Foundry Co., Lynchburg, Va.

10 a.m.—"Nonferrous Castings Defects," by H. M. St. John, metallurgist, Crane Co., Chicago.

11 a.m.—"Selection and Use of Core Oils and Binders," by E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit.

Saturday afternoon—Michigan State College vs. Marquette University.

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CP Super Cycle is the latest CP development in electric tools. The ratio of motor weight to horsepower is the lowest ever built into a portable tool. Super Cycles are easier to handle . . . can be located on work more quickly . . . are less tiring to hold. Best of all, they work at full speed under all loads.

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(*Concluded from page* 133)

now is 2500 to 3000 crankshafts per 16-hour day.

"Guided at every step by x-ray studies and rechecks, the casting of metals has progressed to the point where it offers distinct advantages," according to W. V. Tiscornia, vice president of Auto Specialties. "Casting to exact dimensions often reduces machining time considerably. Cast crankshafts contain free graphite which provides 'built-in' lubrication, dampens motor vibration and improves wearability. As a result, castings possess high rigidity. In addition, it is easier to harden bearings and bearing surfaces through heat treatment when this metal composition is used.

"Another advantage is that steel of high carbon content (1.50 per cent carbon) can be used—steel which could not be handled by other methods.

"Castings," he points, "lend themselves easily to new designs, which in many instances could not be produced at all by other methods. Of particular importance are those designs which eliminate weight, as described previously. An outstanding example, is a new type of pancake crankshaft, about which little can be said now except to indicate that its production would be impossible by any other method.

"This trend toward lower weight, especially in crankshafts, is motivated by the increasing demand for motors of high speed, torque and efficiency."

1946 GRAY IRON CASTING

Shipments Detailed in Report

GRAY IRON castings shipments during 1946 amounted to 10,269,657 short tons, according to the Bureau of the Census, Washington. These shipments were 7 per cent higher than the 9,578,295 tons shipped during 1945, and were 5 per cent greater than the 9,794,541 tons shipped in 1944—the last full wartime year. They were more than 44 per cent greater than the 1939 shipments which totaled a little over 7 million tons.

Statistical breakdowns on shipments and unfilled orders contained in the 17-page report cover types of castings and distribution of castings by months and geographical districts. The accompanying table shows shipments by type of casting for 1945 and 1946.

Monthly shipments of gray iron castings during 1946 varied from a low of 371,894 tons in February to peak shipments of 1,977,838 tons in October. Although shipments fluctuated widely during the year the general trend was upward until October when they fell off slightly. A higher rate of activity during the second half of 1946 accounted for the increase in shipments over that of 1945. During the first half of 1946 shipments lagged behind those of 1945.

Unfilled orders for gray iron castings for sale to the trade showed a steady upward trend during the year. On Dec. 31, 1945, they amounted to 1,877,095 tons and increased to 2,979,658 tons on Dec. 31, 1946—a rise of 59 per cent. At the December rate of activity, unfilled orders at the end of 1946 represented about a six-month's backlog.

The number of months of backlog in terms of the December rate of activity varied for each type of gray iron casting shown in the report. Molds for heavy steel ingots and chilled iron railroad car wheels had backlogs of less than 3 months and less than 4 months, respectively. On the other hand, manufacturers of cast iron pressure pipe lagged 14 months behind their orders and cast iron soil pipe manufacturers were 9 months behind.

Pennsylvania retained its position as the largest gray iron casting producing state, although its shipments decreased from 1945. It accounted for 1,502,154 tons, or 14.6 per cent of the 1946 total. Michigan was second with 1,314,156 tons followed by Ohio with 1,276,861 tons and Illinois with 1,131,831 tons. These four states accounted for a little more than half of the total shipments for 1946.

In total, 2600 foundries reported shipments of gray iron castings during 1946. However, during the year 17 of these discontinued production and in December, 2583 foundries were active. The majority of these foundries are small, and almost half of them shipped less than 1000 tons each during the year, and accounted for less than 5 per cent of total shipments. On the other hand, 85 foundries shipped more than 20,000 tons each and accounted for nearly half the total shipments.

The gray iron foundries covered by the report include all parts containing foundry facilities whether they produce castings for sale or for their own use. Data are not included for castings produced in Navy yards, arsenals, prisons, or in school or experimental laboratories.

The term gray iron castings includes semi-steel, alloy iron, white iron, cast iron pipe and the more common types of gray iron castings. Tonnages represent the weight of the rough castings after gates, risers, sprues, etc., have been removed, but before machining.

SHIPMENTS BY TYPE OF GRAY IRON CASTING

Type of Casting	1946 Quantity (Short tons)	1946 Per Cent	1945 Quantity (Short tons)	1945 Per Cent
Molds for heavy steel ingots	1,397,776	13.6	1,810,562	18.9
Chilled iron railroad car wheels	723,891	7.0	899,561	9.4
Cast iron pressure pipe and fittings	786,314	7.7	602,663	6.3
Cast iron soil pipe and fittings	409,214	4.0	203,033	2.1
All other gray iron castings	6,952,462	67.7	6,062,476	63.3
TOTAL	10,269,657	100.0	9,578,295	100.0

WELDING IN THE IRON FOUNDRY

(*Continued from page* 80)

Success depends largely upon the condition of the cast iron and upon the skill and judgment of the welding operators. Cast iron with a large graphite structure is very difficult to weld. Chances of a successful pressure tight weld are slim. The weld metal appears to roll away from the parent material and a good bead contour is difficult to obtain. This is apparently due to the formation of gas originating at the graphite flakes. Cast iron with a reasonably high amount of combined carbon and more finely divided graphite gives less trouble in this respect.

Electrodes of this type have considerable tendency to produce bead cracking. These cracks are very fine and will not be noticed unless special attention is paid to them. This type of cracking can be minimized by maintaining a decidedly convex bead contour. A preheat of from 250 to 500° F seems to help to some extent.

Because of the stresses set up by multipass welding, peening is essential to prevent cracking of the weld metal. Best results are obtained by the use of a ball nosed peening tool, and rather drastic peening appears to be necessary. The weld should be deposited in beads not more than 3 or 4 in. in length, and thoroughly peened before depositing the succeeding pass. Where full strength of the weld is necessary, each pass should be examined closely for cracks before peening and any defective weld metal removed. An accumulation of these cracks can seriously reduce the effective cross section of the weld and are potential starting points for further cracking. The magnetic powder test can be used effec-

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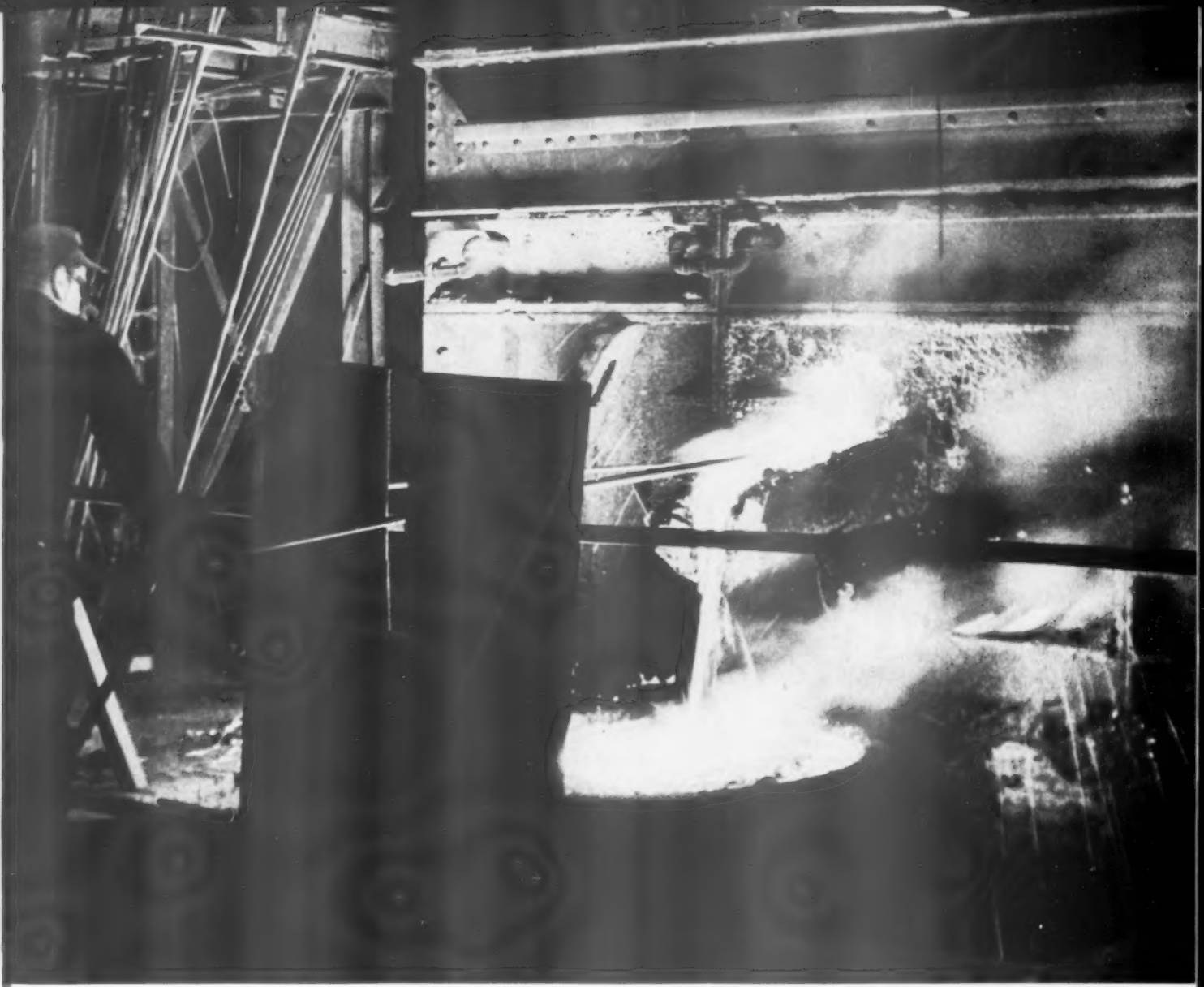

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GRADE "B" *(Crucible)*	Vanadium . . . 35-45% Silicon . . . max. 3.50% Carbon . . max. 0.50%
GRADE "C" *(Primos)*	Vanadium . . . 35-45% Silicon . . . max. 1.25% Carbon . . max. 0.20%
HIGH V GRADES	Vanadium . . . 50-55% 60-65% 70-80% Silicon . . . . . Low Carbon . . . . . Low

Large stocks are carried of all grades of alloys, and they can be supplied in any of the standard lump, crushed, or mesh sizes.

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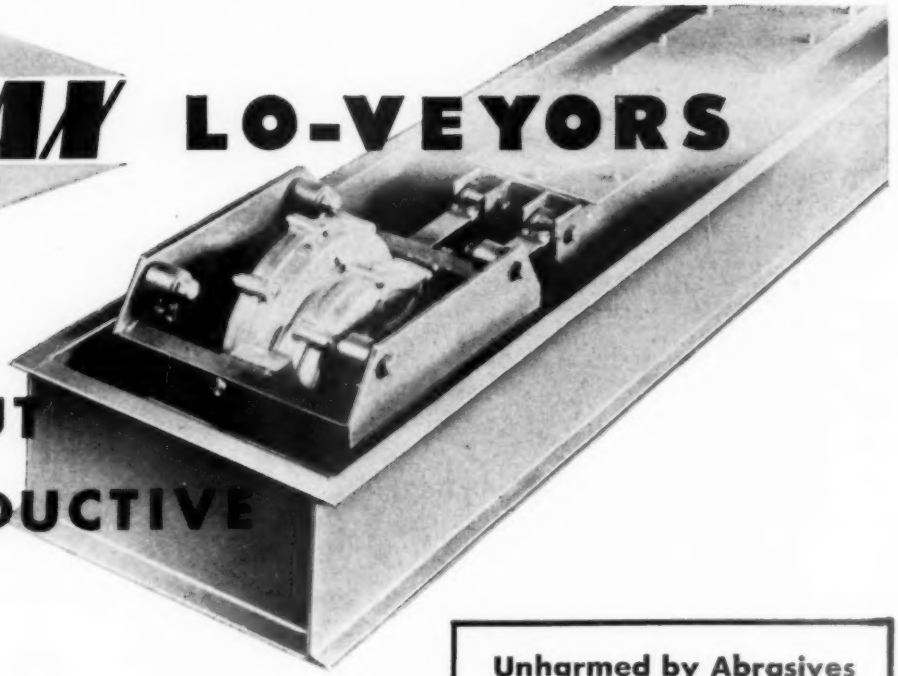
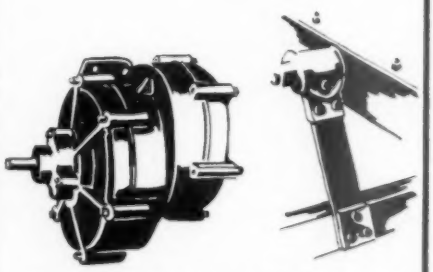
How AJAX LO-VEYORS



MAKE IT EASY TO CUT NON-PRODUCTIVE COSTS

Unharmed by Abrasives



Ajax Shaler-Shaker drive unit is completely enclosed and runs in oil. Rubber bushed conveyor pan supports require no lubrication and are unharmed by abrasive materials. Ajax Lo-Veyor design eliminates conveyor belts, rollers, idler pulleys and bearings.

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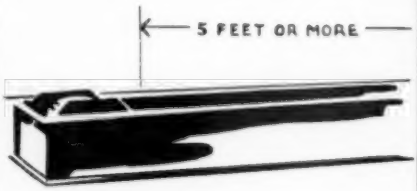

You can use Ajax Lo-Veyors for moving material distances of 5 ft. and up. Material can be moved from one operation to the next . . . plant layouts can be rearranged

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Ajax Lo-Veyors have dozens of applications in moving bulk materials. Tubular or covered pan can provide dust tight, contamination-free operation.

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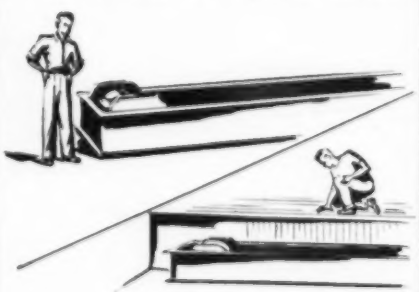


Can be installed under railroad tracks for unloading hopper cars . . . can be set on the floor . . . can be installed below floor level . . . can be suspended from wall or ceiling. Ajax Lo-Veyors are complete units delivered ready to use.

You need no longer think of conveying equipment as expensive. In fact, Ajax Lo-Veyors not only cut costs of handling bulk material but are low in first cost and low in operating and maintenance costs.

Under present conditions, savings on handling material are one of your most important opportunities for cost reduction. Ajax Lo-Veyors are being used by the Who's Who of Industry for moving dry materials,— explosive and non-explosive. Their record of satisfaction is one of their strongest recommendations. Write telling us what you have to move.

AJAX FLEXIBLE COUPLING CO. INC.

WESTFIELD, NEW YORK

(*Concluded from page* 136)

tively in the detecting of such cracks. A build-up may be expected at the fusion line of the weld metal and cast iron bebecause of the difference in permeability of the two materials.

Fig. 4 is a photomicrograph taken from a broken cast iron part with large graphite flakes which was being repaired by welding with the metal arc process using a coated nickel electrode. So much trouble was encountered that repairing by this method finally was abandoned. Note the size of the graphite flakes and the complete lack of combined carbon. This type of trouble is not encountered in gas welding. Fig. 5 is a micro of a weld made with the same electrode on cast iron with smaller graphite flakes with more of the carbon in the combined state. Note that a much better bond has been obtained at the line of fusion. Normally, cast iron in this condition gives little trouble from fusion line cracking.

Preheat the Casting

Fig. 2 shows a large cast iron part in which several small defects were discovered during machining. The defects were chipped out as shown in Fig. 3. The casting then was preheated locally to 500° F and welded using a nickel electrode. No trouble was encountered in the machining operation in the form of a hard zone at the fusion line.

Of the two processes discussed, gas welding with cast iron filler will produce the most consistent results and is usually most economical for large scale repairs. This process, therefore, lends itself well to foundry operations. The arc welding process finds its application chiefly in repairing castings which cannot be readily preheated or are in a finished machined stage where distortion must be held to close limits.

If consistent results are to be obtained with either process, certain fundamentals must be observed:

1. The procedure must be outlined, recorded and sufficient test welds investigated to prove that the procedure will yield satisfactory results.

2. Proper equipment and facilities for welding preheating, and post heating must be provided.

3. Competent and interested supervision must be provided.

4. Operators must be trained and qualified.

Efficient and economic operations with good quality welds cannot be expected if welding is regarded as a necessary evil and tucked away in an out of the way corner of the shop with little or no supervision.

Once organized, the welding setup becomes an important manufacturing function. If it is to be successful, it must be recognized as such and placed on a par with the other manufacturing processes.

COMPRESSED AIR USE

Discussed in New Handbook

TO AID users of compressed air power, the Compressed Air and Gas Institute, 90 West St., New York 6, has compiled and edited the *Compressed Air Handbook*—an authoritative 356-page guide for the proper installation, use and maintenance of air compressors and air-actuated equipment.

The book has been under preparation for the last year and a half. It is divided into five chapters which present an account of some of the many uses of compressed air in everyday work. Air compression machinery and other equipment made to meet varying requirements for capacities and uses of air is described and illustrated. No attempt is made, however, to catalog completely the many types of equipment made by each manufacturer.

A section is devoted to definitions, classifications, information on application and other technical data relative to air-operated devices and mechanisms. Suggestions and data on the selection, installation, operation and care of compressed air plants are offered. The final section of the book contains engineering data and standards established by the Compressed Air and Gas Institute. Here terms are defined, rating standards stated, data, tables and formulas given, and test procedures explained.

In the section devoted to planning a suitable compressed air system for a plant, suggestions are made for a survey to provide basic information in approaching the problem of engineering the compressed air installation. These include an analysis of the required compressor capacity, number of compressor units and their location, regulation of the compressed air plant and air distribution.

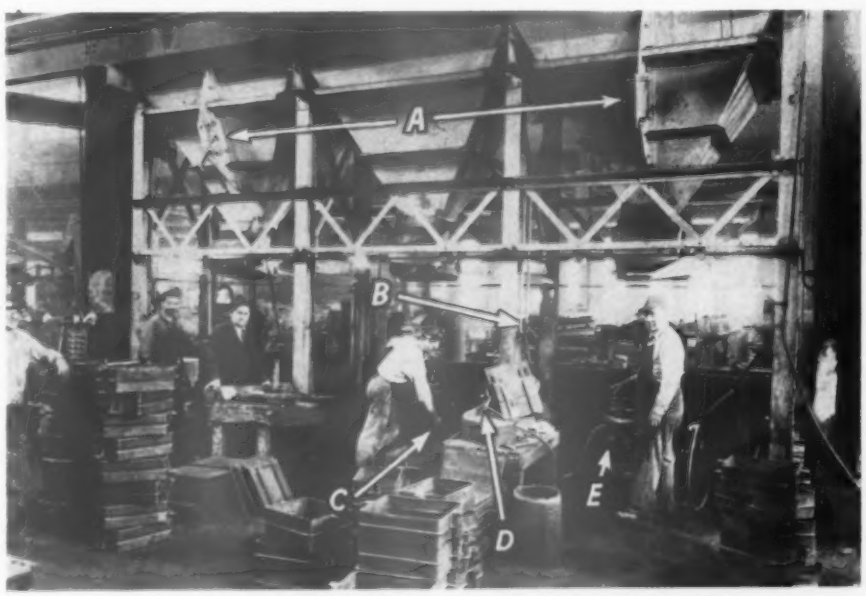
Low air pressure in a compressed air system is costly and wasteful. By low air pressure is meant inadequate pressure at the tool or device which is air operated. This is the point where the volume and pressure of air available becomes effective in doing work.

Causes of low air pressure are classified as insufficient compressor capacity, inadequate piping and leakage. It is suggested that before additional or larger compressors are installed a thorough check of the system be made to eliminate leakage and to determine if pipe size is capable of carrying correct air volumes and pressures to operate the devices.

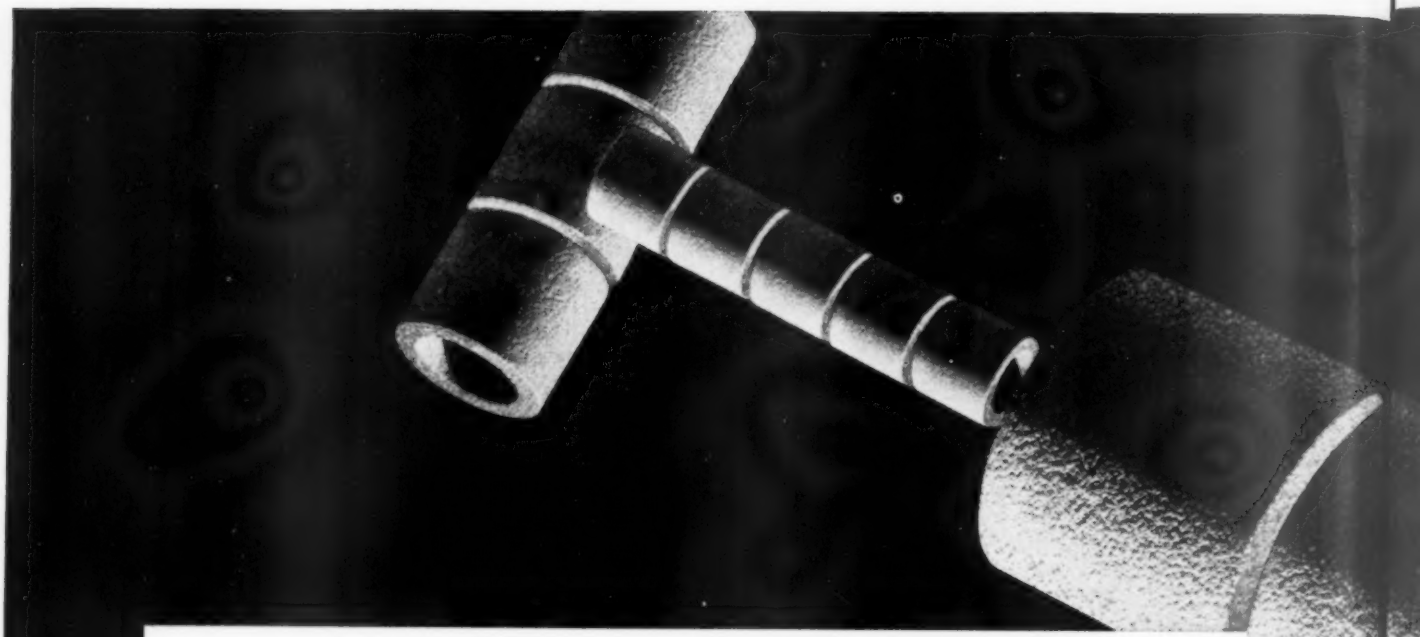
Compressor engineering, installation and maintenance are covered for stationary and portable type reciprocating compressors, rotary compressors and vacuum pumps and centrifugal and axial blowers, compressors and exhausters.

In discussing stationary reciprocating compressors the handbook advises that they be placed in a clean, well-lighted area of sufficient size to permit cleaning, inspection and any dismantling which might be necessary. The room in which the compressor is located should be as free from dust as possible and outside air should be brought to the compressor intake through a filter. The intake

(*Concluded on page* 142)



Typical compressed air applications in a foundry. *A*—sand bin vibrators; *B*—valve controlling bin vibrators; *C*—valve for operating squeezer on molding machine; *D*—pattern vibrator; *E*—knee valve for operating jolt



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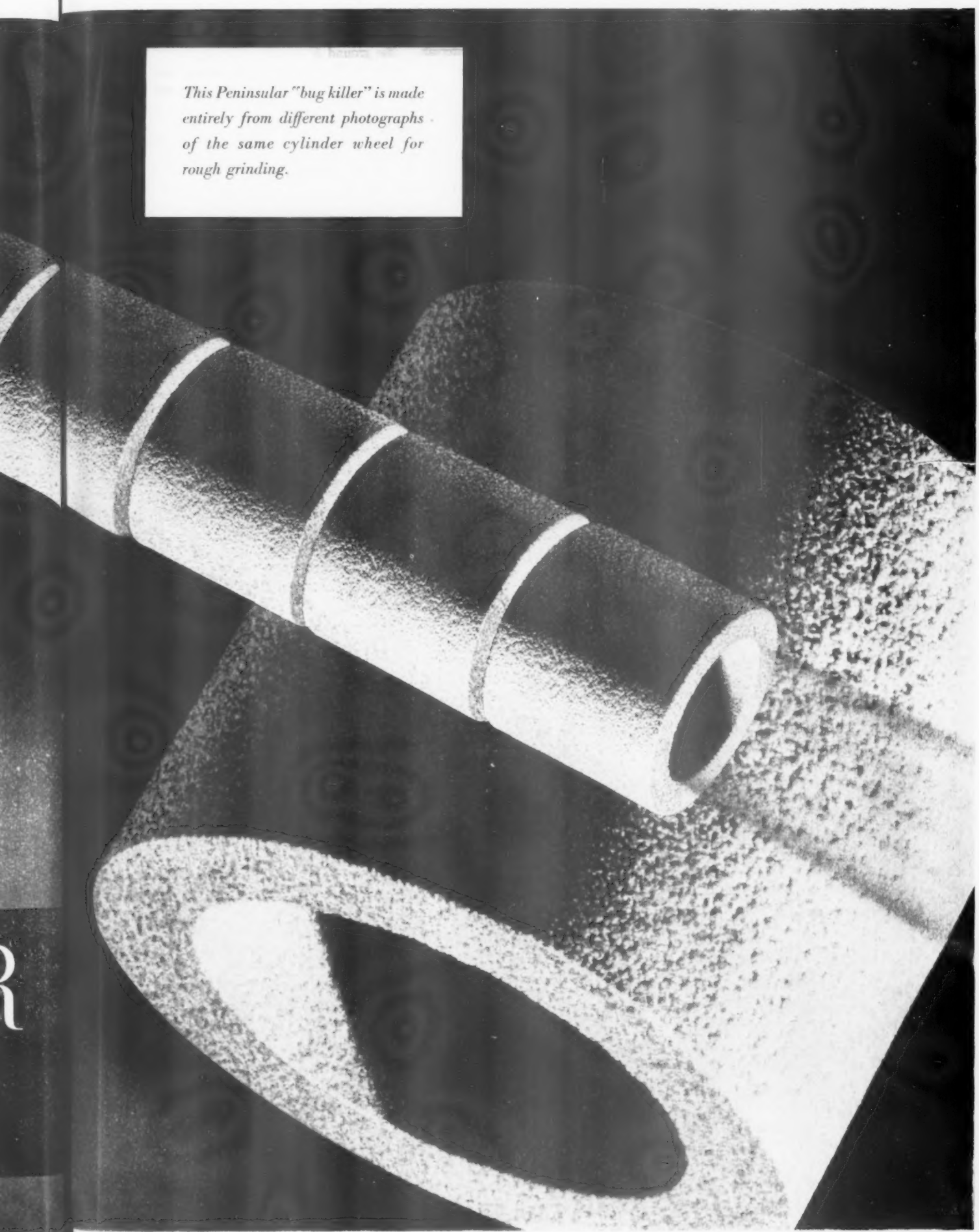

This Peninsular "bug killer" is made entirely from different photographs of the same cylinder wheel for rough grinding.

(*Concluded from page 139*)

should be several feet away from any wall or window because pulsations around the intake may rattle windows and damage a weakly constructed wall. The intake line should be as short and direct as possible and at least the full diameter of the compressor intake opening.

Likewise, the discharge pipe should be no smaller than the compressor outlet and as short and direct as possible, leading to the aftercooler or air receiver.

Pipe lines through which hot air passes must be kept clean to avoid fire starting in accumulated dirt and oil. Air lines should contain traps at frequent intervals to remove condensed moisture.

Circulating water should be supplied for cooling cylinder jackets, cylinder heads, intercoolers and aftercoolers. Suggestions are made for proper inspection and lubrication of compressors.

The same general precautions as to operation and care pertinent to reciprocating machines apply to rotary, centrifugal and axial machines.

RESEARCH INSTITUTE

To Serve Smaller British Firms

By VINCENT DELPORT
European Manager
The Foundry

SOMETHING new in the field of industrial research in Great Britain is the Fulmer Research Institute, which was formally opened by Sir Stafford Cripps, president of the Board of Trade, July 2. This institute has been founded by a group of firms, mainly engaged in the preparation and processing of high-duty alloys, and the moving spirit of the scheme was Col. W. C. Devereux, a director of International Alloys Ltd., at Slough, Bucks., who is the first chairman.

The object of the Fulmer Research Institute, which is a nonprofit organization is to provide facilities for research to small and medium size firms that are unable to set up their own laboratories and equipment and engage the necessary expert staff. The institute will carry out independently sponsored work on a strictly confidential basis. For the present, the work of the institute will be confined to the metallurgical field, embracing all metals and alloys.

Founders of the institute have secured a site in the small village of Fulmer, about 3 miles from the industrial center of Slough, some 20 miles from London.

The plant and equipment acquired for the purpose of conducting metallurgical research over an extended field is of the latest type. Three rooms are devoted to the metallographic and photographic section. Next to the metallographic department is a corrosion and plating laboratory, fully equipped. Next to this is a spectrographic laboratory. Two laboratories have been set aside for specialized work involving high vacuums and temperatures. The chemical laboratories consist of a main general chemical laboratory, one laboratory set aside for colorimetric and absorptiometric work, a small laboratory for microchemical analysis and other specialized work, and a balance room where the temperature is controlled.

Main building of the Fulmer Research Institute in Fulmer village, about 20 miles from London

All of these laboratories are situated on the first floor of the building. On the ground is installed the heavy plant and equipment. The engineering and creep laboratories occupy one large and one smaller room. The main physics laboratory is used for measurements of electrical and thermal conductivty, instantaneous specific heat, static and dynamic strain, and coefficient of thermal expansion and other dilatometric work. In a smaller lead-lined room is crystallographic x-ray set.

In a new extension to the main building is an experimental casting laboratory. Melting equipment consists of a medium-frequency induction furnace, motor generator type, equipped for melting in special atmospheres or in a vacuum; a 38-lb electric resistance furnace; a 20-lb oil-fired furnace; a tilting indirect arc furnace suitable for precision castings; a large electrically heated and controlled core drying oven, which can also be used for low temperature heat treatment, and a sand mill.

Leading from this laboratory is a small pattern and diemaking room. On the opposite side is a sand testing laboratory, adjacent to which is a spraying booth for paint, metal, etc., and a shot blast cabinet and cutting-off circular saw.

The heat treatment section houses four furnaces of varying size and shape for general heat treatment. The machine shop, with a staff of six, contains a variety of plant and equipment sufficient to deal with all the work required by the various departments, and also to construct some of the additional equipment as required.

In the main building is a well appointed conference room, a general study room where investigators can write their reports and prepare drawings, a library and reading room. The institute has also provided a canteen.

The staff which has been assembled at the Fulmer Research Institute includes men with both research and industrial experience. The director of research is E. A. G. Liddiard, who was graduated from Cambridge University and has had industrial experience with Cammell, Laird & Co., Imperial Chemical Industries, and who was later assistant development officer and then research manager at the British Non Ferrous Metals Research Association. Dr. P. Gross, who was professor of physical chemistry at the University of Vienna before the war, is the principal scientist, and Dr. A. H. Sully, who was graduated from the University College of North Wales, and later joined the staff of the Mond Nickel Co., is the principal physicist. The staff also includes eight fully qualified metallurgists, physicists and engineers, and a librarian.

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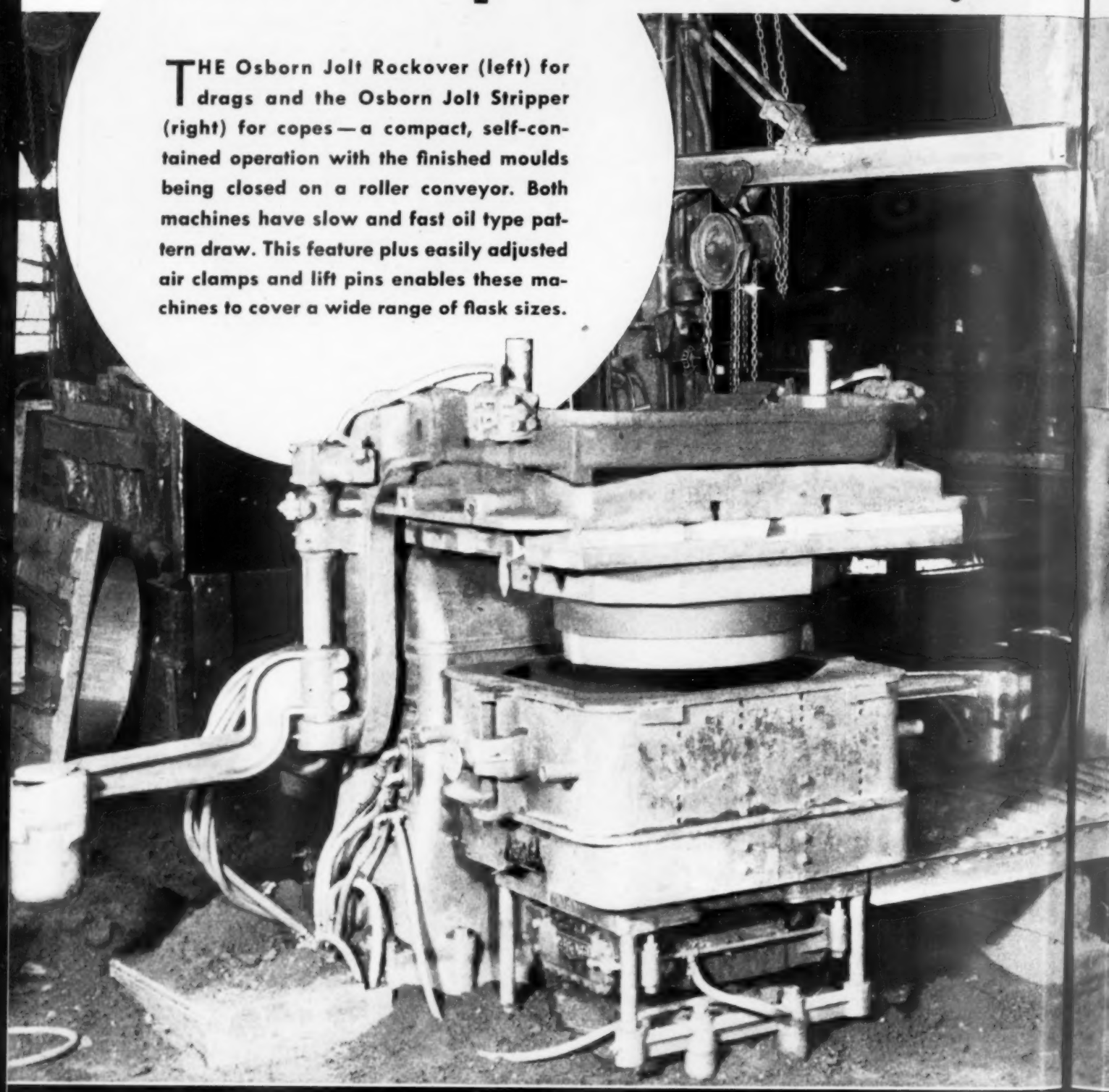
Maximum production *with*

THE Osborn Jolt Rockover (left) for drags and the Osborn Jolt Stripper (right) for copes—a compact, self-contained operation with the finished moulds being closed on a roller conveyor. Both machines have slow and fast oil type pattern draw. This feature plus easily adjusted air clamps and lift pins enables these machines to cover a wide range of flask sizes.



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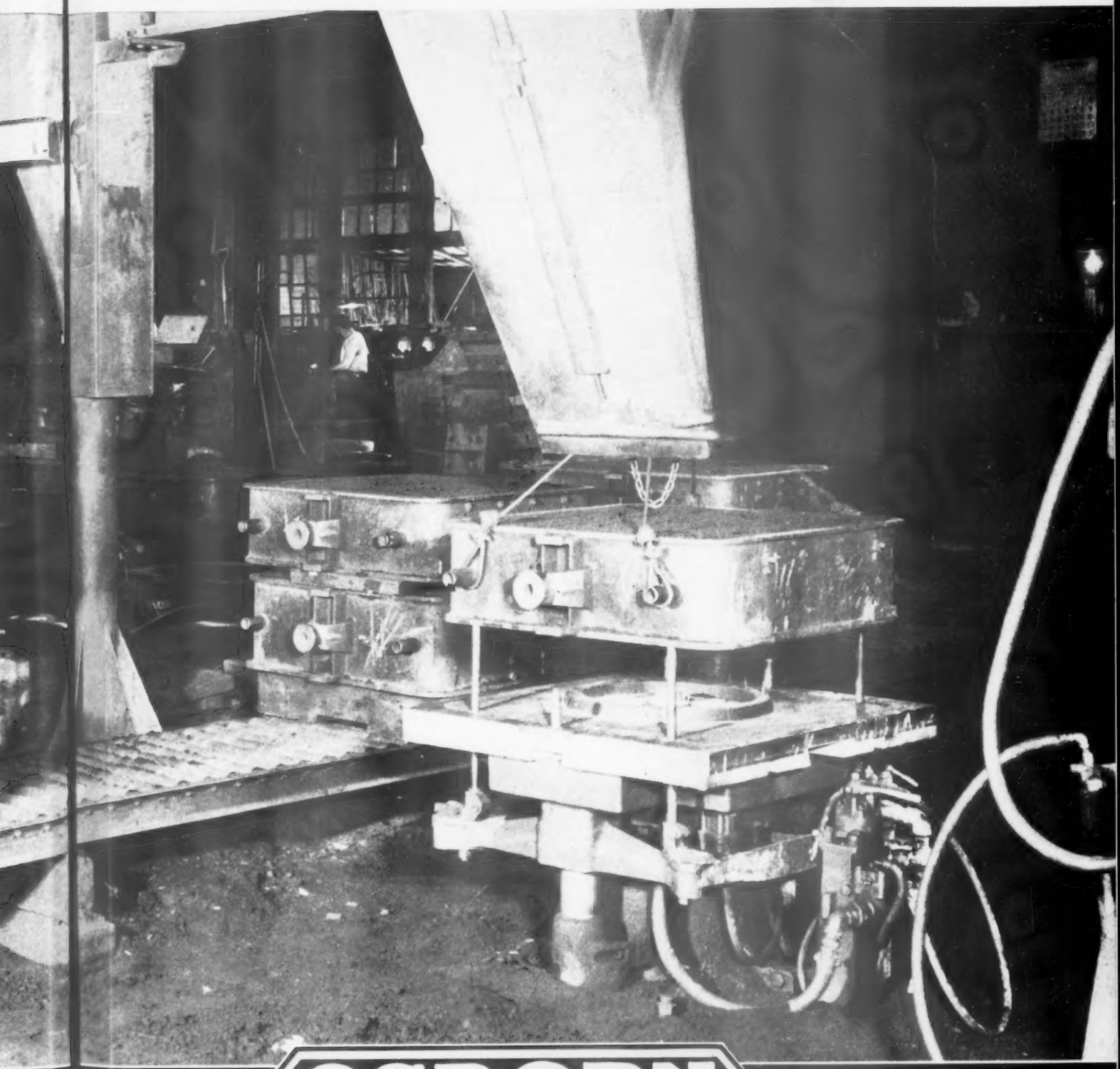

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FOUNDRY EQUIPMENT

Activities of Foundry GROUPS

Central Ohio

APPROXIMATELY 200 members of the Central Ohio Chapter of the AFA turned out Aug. 9 for the chapter's third annual outing at Columbus Riding Club. From 2 to 7 p.m. the program consisted of a variety of sports and games, including baseball, horseshoe pitching, dart throwing, story swapping and card games. The baseball game was unique in that two teams were in the field and three at bat at all times.

Dinner was followed by the awarding of more than 100 door prizes contributed by a number of organizations interested in the foundry industry. The program was topped off with an entertaining floor show.

Success of the picnic was due, in large part, to the effort of a committee of 16 men operating under the chairmanship of Gray Lummis, A. P. Green Fire Brick Co., and to the newly elected officers including Chairman Ray Frank, Bonney-Floyd Co.; Co-chairman Fred Fuller, National Engineering Co.; Secretary Dan Krause, Battelle Memorial Institute, and Treasurer Bill Hoffman, H. B. Salter Mfg. Co.

First formal meeting of the new season is scheduled for Oct. 27 with L. W. Dean, Dean Co., Chicago, speaking on "Precision Castings."—*H. W. Lownie Jr., Battelle Memorial Institute.*

Pittsburgh

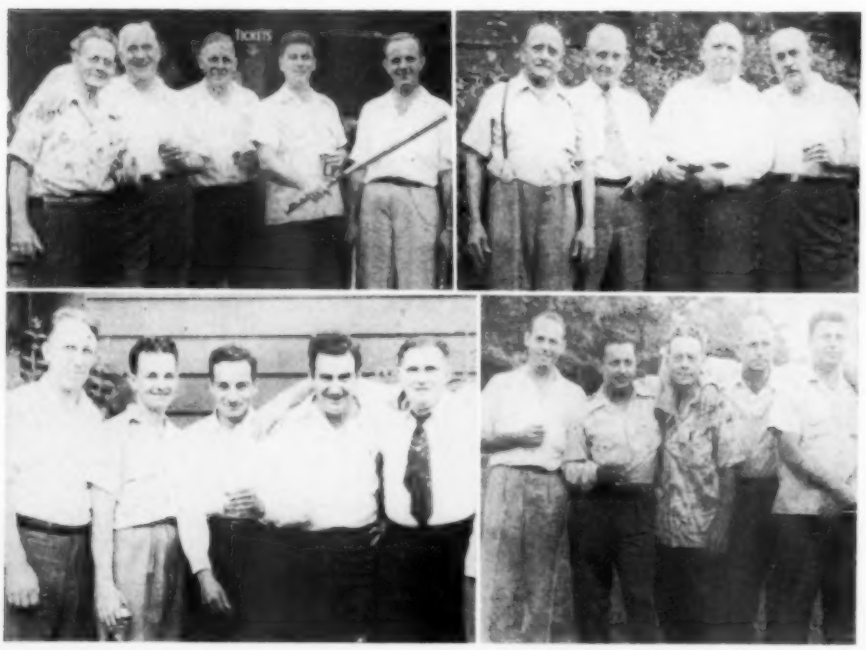
PITTSBURGH Foundrymen's Association held its initial meeting of the 1947-48 season, Sept. 15 at the Fort Pitt Hotel, Pittsburgh.

Earl L. Shaner, president, Penton Publishing Co., Cleveland, addressed the group, highlighting his experiences on a trip around the world as a member of the United States Reparations Commission. Mr. Shaner presented his conclusions as to what current conditions abroad mean to industrial companies in the states, with emphasis on the foundry industry in particular.

New officers of the PFA for the coming season are: A. M. Cadman, A. W. Cadman Mfg. Co., president; C. B. Dick, Westinghouse Electric Corp., vice president; and E. P. Buchanan, Pittsburgh Coke & Chemical Co., secretary-treasurer.

Chairmen of the association's various technical committees this year are: William J. Laird, Westinghouse Electric Corp., chairman of the nonferrous technical committee; August Rossetti, Schaefer-Goodnow Foundries Inc., chairman of gray iron committee; J. H. Houston, Walworth Co., chairman of the malleable iron committee; and Ray L. English, National Alloy Division, Blaw-Knox Co., chairman of the steel technical committee.

Chairman of the executive committee is Henry P. Spilker, Sterrit-Thomas Foundry Co.; program committee, M. J. Kellner, Westinghouse Electric Corp.; membership and attendance committee, H. D. Fowler, J. S. McCormick Co.; and entertainment committee, Day E. Cutler, J. S. McCormick Co.—*Joseph C. Sullivan.*



CENTRAL OHIO: Some of the members of Central Ohio Chapter of the AFA who attended the chapter's annual outing Aug. 9 at Columbus Riding Club. At upper right are some "old timers" and at lower right are members of the outing committee. Photos by Wilfred H. White, Jackson Iron & Steel Co., Jackson, O.

Wisconsin

WISCONSIN Chapter of the AFA has announced its committee chairmen for the 1947-48 season. They are: Conference and educational, R. C. Woodward, Bucyrus-Erie Co., South Milwaukee; apprenticeship, Maxwell Snow, Milwaukee; program, Walter Edens, Badger Brass & Aluminum Co., Milwaukee; policy, David C. Zuege, Sivyer Steel Casting Co., Milwaukee; membership, S. E. Shaver, Werner G. Smith Co., Milwaukee; publicity and official photographer, John Bing, A. P. Green Fire Brick Co., Milwaukee; safety & hygiene, Arthur Grede, Grede Foundries Inc., Milwaukee.

Special committee on engineering for University of Wisconsin, B. D. Claffey, General Malleable Corp., Waukesha, Wis.; audit, Ralph Lee, Grede Foundries Inc., Wauwatosa, Wis.; student aid, Walter Gerlinger, Walter Gerlinger Inc., Milwaukee; arrangements, Harold O. Boehm, Allis-Chalmers Mfg. Co., Milwaukee; entertainment, D. W. Thiem, Thiem Products Co., Milwaukee; old timers & apprentice, Leon Decker, Allis-Chalmers Mfg. Co.; golf, C. L. Tanner, Tews Lime & Cement Co., Milwaukee, and nominating, H. Ladwig, Allis-Chalmers Mfg. Co.

Eastern Canada and Newfoundland

BOARD of directors of the Eastern Canada and Newfoundland Chapter of the AFA met on June 2 to work out general plans for the coming season's activities and to confirm nominations of committee chairmen and vice chairmen for the 1947-48 season.

Committee chairmen are: Program, James H. Newman, Newman Foundry Supply Ltd., Montreal; education, O. L. Voisard, Robert Mitchell Co. Ltd., St. Laurent, P. Q.; membership, W. J. Brown, Robert W. Bartram Ltd., Montreal; entertainment, John Shewan, Canadian Car & Foundry Co. Ltd., Turcot

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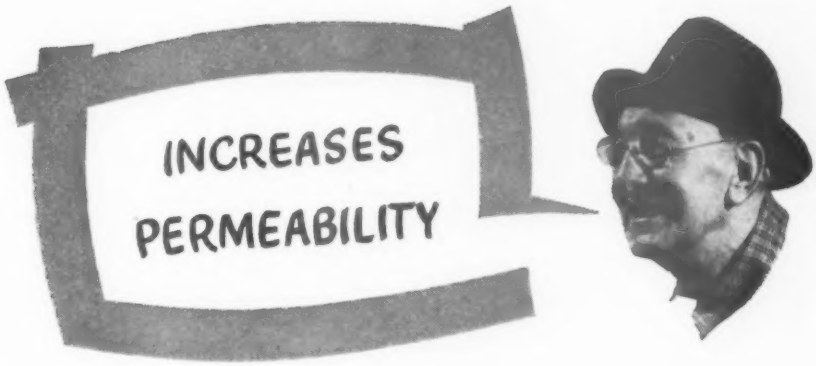

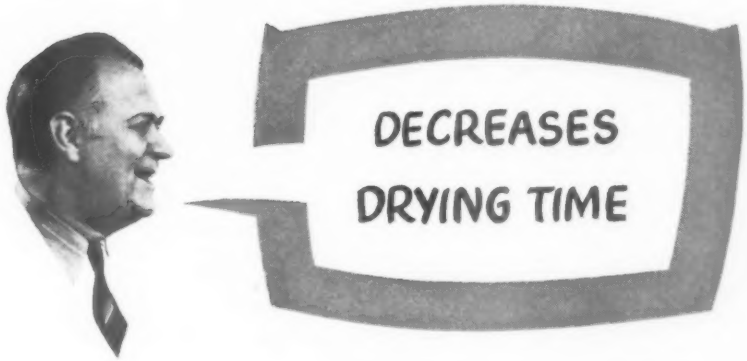

Foundry management, watching mounting costs, sees profits in MOGUL. This perfect Green Bond makes money because it decreases drying time, yields smooth cores and reduces discards. MOGUL works profitably with pitch or resin because cores can be handled warm. For both green and dry strength use MOGUL in cores.

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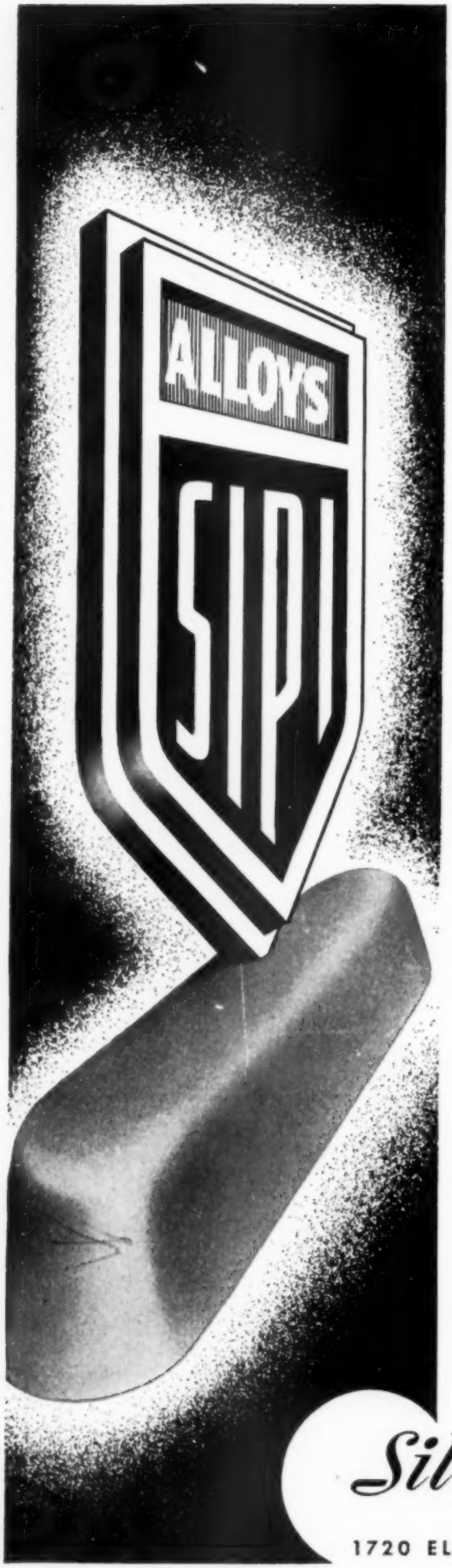

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NORTHWESTERN PENNSYLVANIA: Views of the second annual picnic held by Northwestern Pennsylvania Chapter of the AFA at Ranchero and Lake Shore Golf Club, near Erie, Pa., Aug. 23.

(*Continued from page* 146)

Works, Montreal, and publicity, H. E. Francis, Jenkins Bros. Ltd., Montreal.

Chapter officers are: Chairman, A. E. Cartwright, Crane Ltd., Montreal; vice chairman, O. L. Voisard, Robert Mitchell Co. Ltd., St. Laurent, P. Q.; secretary, J. G. Hunt, Dominion Engineering Works Ltd., Lachine, P. Q. and treasurer, L. Guilmette, Canadian Foundry Supplies & Equipment Ltd., Montreal.

Directors for term expiring in 1948 are: Del. Allard, director of shop work and educational films arts and crafts department, Provincial government; H. E. Francis, Jenkins Bros. Ltd., Montreal. Ed. Laurendeau, Canadian Pattern & Woodworking Co., Montreal; James H. Newman, Newman Foundry Supply Ltd., Montreal, and O. H. Seveigny, Lynn Macleod Metallurgy Ltd., Thetford Mines, P. Q.

Directors for term expiring in 1949 are: W. L. Bond, Ottawa Car & Aircraft Ltd., Ottawa, Ont.; C. C. Brisbois, Sorel Industries Ltd., Sorel, P. Q.; W. J. Brown, Robert W. Bartram Ltd., Montreal; W. M. Hamilton, Crane Ltd., Montreal, and John Shewan, Canadian Car & Foundry Co. Ltd., Montreal.

Directors for term expiring in 1950 are: Rene Belisle, La Cie J. A. Gosselin

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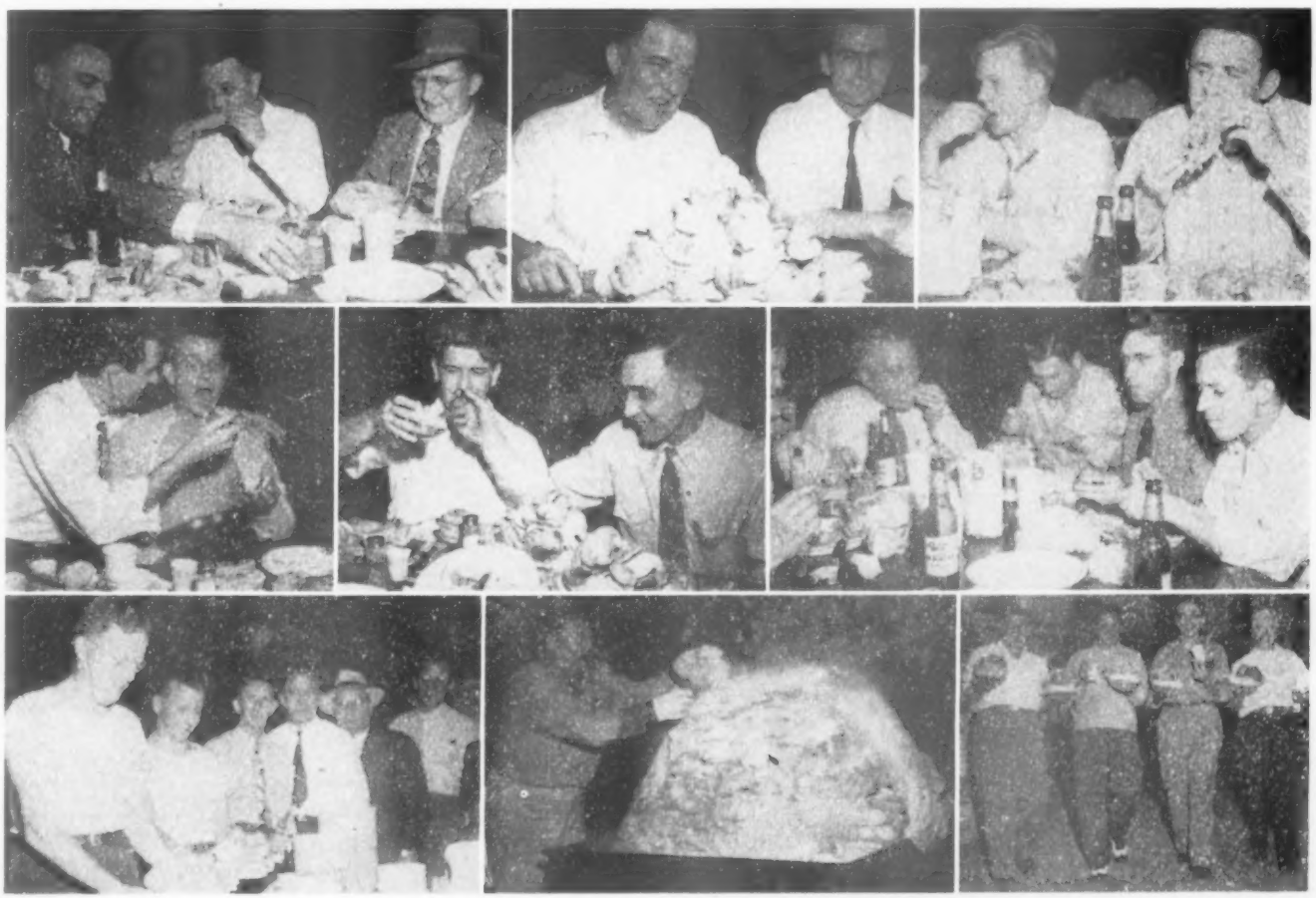

CENTRAL ILLINOIS: Annual clambake was held by the Central Illinois Chapter of the AFA on June 21. Photos courtesy Caterpillar Tractor Co.

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JOLT SQUEEZERS

GIVE YOU *Better Molds . . . and More of 'em!*

ORIGINAL PARALLELISM BETWEEN PLATEN and TABLE *Always Maintained!*

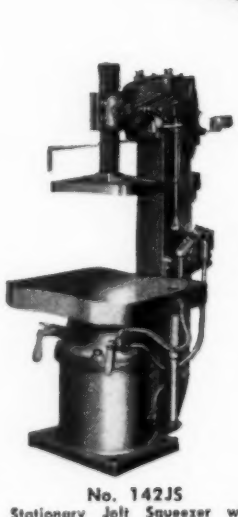
No. 103
Stationary Jolt Squeezer with 10" squeezing piston. Accessible from 3 sides.

Milwaukee Jolt Squeezers give you the accuracy you need at all times to get better molds . . . and more of 'em! Platen and table are kept in alignment because they are designed to maintain original parallelism regardless of hinge pin wear. This construction makes ram-offs impossible! Milwaukee Jolt Squeezers are ruggedly built and easy to operate. Intensity of jolt for light or heavy molds is easily controlled by simply turning a choke screw in the side of the jolt valve. When working in a wide range of pressures, squeeze accuracy is maintained by operating a conveniently located squeeze valve handle. Upkeep is low because renewable surfaces are provided at wearing points to simplify and reduce maintenance.

It's New!

MILWAUKEE-TACCONE CORE BLOWER

Bench-type core blower designed to blow better cores up to 2½ lb. size, as fast as operator can remove them from core box. Explosion type action. Requires only small line of air . . . No manual labor. Low maintenance cost. Write for further particulars.



No. 142JS
Stationary Jolt Squeezer with 14" squeezing piston. Not available in portable type.

No. 124
Portable Jolt Squeezer with 12" squeezing piston, steel wheels and mold shelf.

MILWAUKEE *Foundry Equipment Co.*

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(*Continued from page* 149)

Ltee, Drummondville, P. Q.; James Grieve, Dominion Engineering Works Ltd., Lachine, P. Q.; Wilfred E. Hillis, Hillis & Sons Ltd., Halifax, N. S.; M. A. Hughes, Lasalle Coke Co., Montreal, and W. T. Shute, Canadian Car & Foundry Co. Ltd., Longue Pointe, P. Q.—*A. E. Cartwright, Crane Ltd., Montreal.*

Northwestern Pennsylvania

NORTHWESTERN Pennsylvania Chapter of the AFA held its second annual picnic at Ranchero and Lake Shore Golf Club, Aug. 23. Approximately 125 members and guests attended.

James J. Farina, American Sterilizer Co., and chairman of the entertainment committee was in charge of the picnic. Other members of the entertainment committee are: Courtney Wilcox, Cascade Foundry; Harold Lolley, Bucyrus Erie Co.; Fred J. Carlson, Weil-McLain Co.; Frank P. Volgstadt, Griswold Mfg. Co.; William Bartels, Erie Malleable Iron Co., and Steve R. Stroup, Peerless Mineral Products Co.

The chapter opened the 1947-48 season with a meeting Sept. 22. Subsequent meetings will be held the fourth Monday of each month until next June.—*Earl M. Strick, Erie Malleable Iron Co.*

Northern California

ANNUAL "Ladies Night" of the Northern California Chapter of the AFA was held June 20, at the Palace Hotel, San Francisco, with approximately 200 members, guests and their wives in attendance. Dan Henry, Federated Metals Division, American Smelting & Refining Co., chairman of the entertainment committee, assisted by Jay Snyder, Musto Keenan & Sons, and Pete Valentine, Del Monte Properties Co., Pacific Groves, handled arrangements for the dinner, dancing and entertainment which is an annual tribute to the wives who stay at home on chapter meeting nights throughout the year so that their husbands can further the interest of the foundry industry.

Prior to the dinner, Sam Russell, Phoenix Iron Works, Oakland, chairman of the chapter's nominating committee, and national director of the AFA, reported the committee's choice of chapter officers to serve during the year 1947-48. Secretary Fred Aicher, E. A. Wilcox Co., San Francisco, was instructed to cast a unanimous ballot for the nominees. Newly elected officers include the following: President, A. M. Ondreyco, Vulcan Foundry Co., Oakland; vice president, George McDonald, H. C. Macaulay Foundry Co., Berkeley; secretary, J. Fred Aicher; treasurer, Fred A. Mainzer, Pacific Brass Foundry Co., San Francisco; and co-secretary, Charles R. Marshall, Chamberlain Co., Oakland.

Directors elected for the coming year are: William E. Butts, General Metals Corp., Oakland; H. Milton Nystrom, Vulcan Steel Foundry, Oakland; John R. Russo, General Foundry Service Corp.; and Roy C. Wendelbo, De Sanno Foundry & Machine Co.

The following appointments as committee chairmen for the 1947-48 term have been announced: Program, H. Milton Nystrom, Vulcan Steel Foundry; Membership, W. W. Clark, Enterprise Engine & Foundry Co.; Publicity, Harold E. Henderson, H. C. Macaulay Foundry Co.; Entertainment, John R. Russo, General Foundry Services Corp.; Finance, William E. Butts, General Metals Corp.; Educational, Ralph C. Noah, San Francisco Iron Foundry Co.; Attendance, Roy C. Wendelbo, De Sanno Foundry & Machine Co.; and Reception, Paul G. Jordan, Vulcan Foundry Co.

Members of the apprentice training committee include Ralph Noah, San Francisco Iron Foundry Co., who will handle San Francisco and the Peninsula area, and the following members who will supervise the Oakland-Berkeley vicinity: James E. Williamson, General Metals Corp.; Roy C. Wendelbo, De Sanno Foundry & Machine Co.; Richard C. Nelson, Pacific Steel Casting Co.; and James L. Francis, Vulcan Foundry Co.—*Charles R. Marshall, Chamberlain Co.*

Central Michigan

APPROXIMATELY 200 foundrymen attended the all-day outing of the Central Michigan Chapter of the AFA, held Aug. 16 at Water Works Park, Coldwater, Mich.

Of the various scheduled sporting events, softball and horseshoe pitching attracted the largest number of players. Excitement during the softball games reached a climax when a team from the Albion Malleable Iron Foundry challenged any team at the picnic. The

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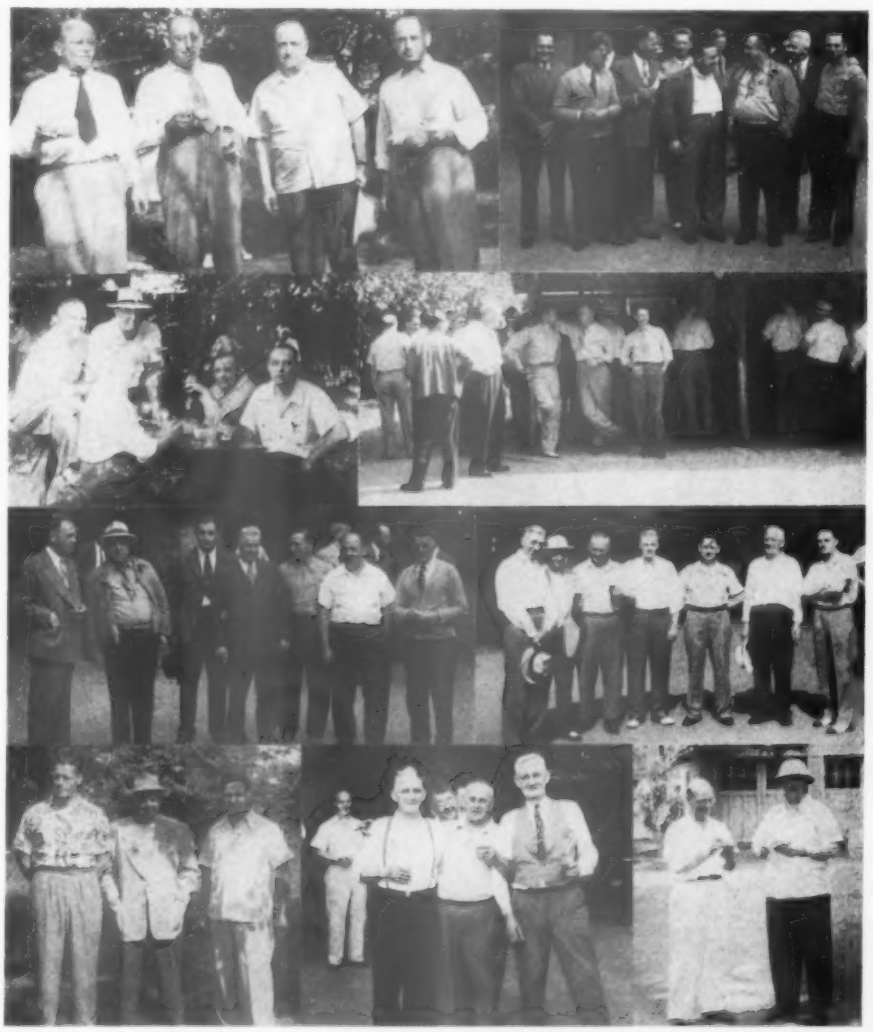

WESTERN NEW YORK: A few of the participants in the annual outing of Western New York Chapter, AFA, held June 28 at Sturm's Grove near Buffalo. More than 300 members and guests attended. Photos by A. J. Heysel, E. J. Woodison Co., and H. C. Winte, Worthington Pump & Machinery Corp.

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(*Continued from page* 151)

challenge was taken up by a team made up of players from various Central Michigan foundries. The Albion outfit won, 8 to 2.

Master of ceremonies for the evening's entertainment was Chapter Chairman Douglas J. Strong, Foundry Materials Co., Coldwater, who made good the promise that everyone would be royally entertained "until the last cat was hung." As it turned out, the cat appeared in fine shape but the boys failed to hang her due to an acute rope shortage.

General chairman for the outing was Edward H. Schlepp, Riverside Foundry & Galvanizing Co., Kalamazoo, Mich. F. Coughlin Jr., Albion Malleable Iron Co., was in charge of ticket sales.— *C. C. Sigerfoos, Michigan State College.*

Southern California

SOUTHERN California Chapter of the AFA held its tenth annual summer outing Saturday, Aug. 9, at Lakewood Country Club, Long Beach, Calif. More than 350 foundrymen were present, and Pat Dwyer, THE FOUNDRY, and his brother, Richard Dwyer, were guests.

In the golf tournament, Johnnie Wilson won the blind bogey first prize and Mr. Rice won the low total prize. The ball game ended in a 20-20 tie, with both sides getting about the same number of hits, bashed thumbs and sore and aching muscles.

Pete Valentine and his musicians from San Francisco entertained the group during the afternoon. After dinner, President Hal Russill announced the appointment of Bob Gregg as a national director of the AFA.—*Ralph N. Schaper, Westlectric Castings Inc.*

Northeastern Ohio

G. VENNERHOLM, assistant head of research in Ford Motor Co.'s chemical and metallurgical department, was the principal technical speaker at the opening fall meeting of the Northeastern Ohio Chapter of the AFA. Held at the Cleveland Club, Sept. 11, the meeting attracted approximately 250 members and guests. An added feature was a complete clambake dinner preceding the meeting.

James H. Lansing, consulting engineer, the Malleable Founders' Society, gave the coffee talk, discussing the activities of his organization and describing the metallurgical developments which have occurred in malleable castings since the early days of the industry.

Howard G. Gollmar, chapter president, presided at the meeting, with Elmer C. Zirzow, chapter vice president, in charge of the technical portion of the

(*Concluded on page* 156)

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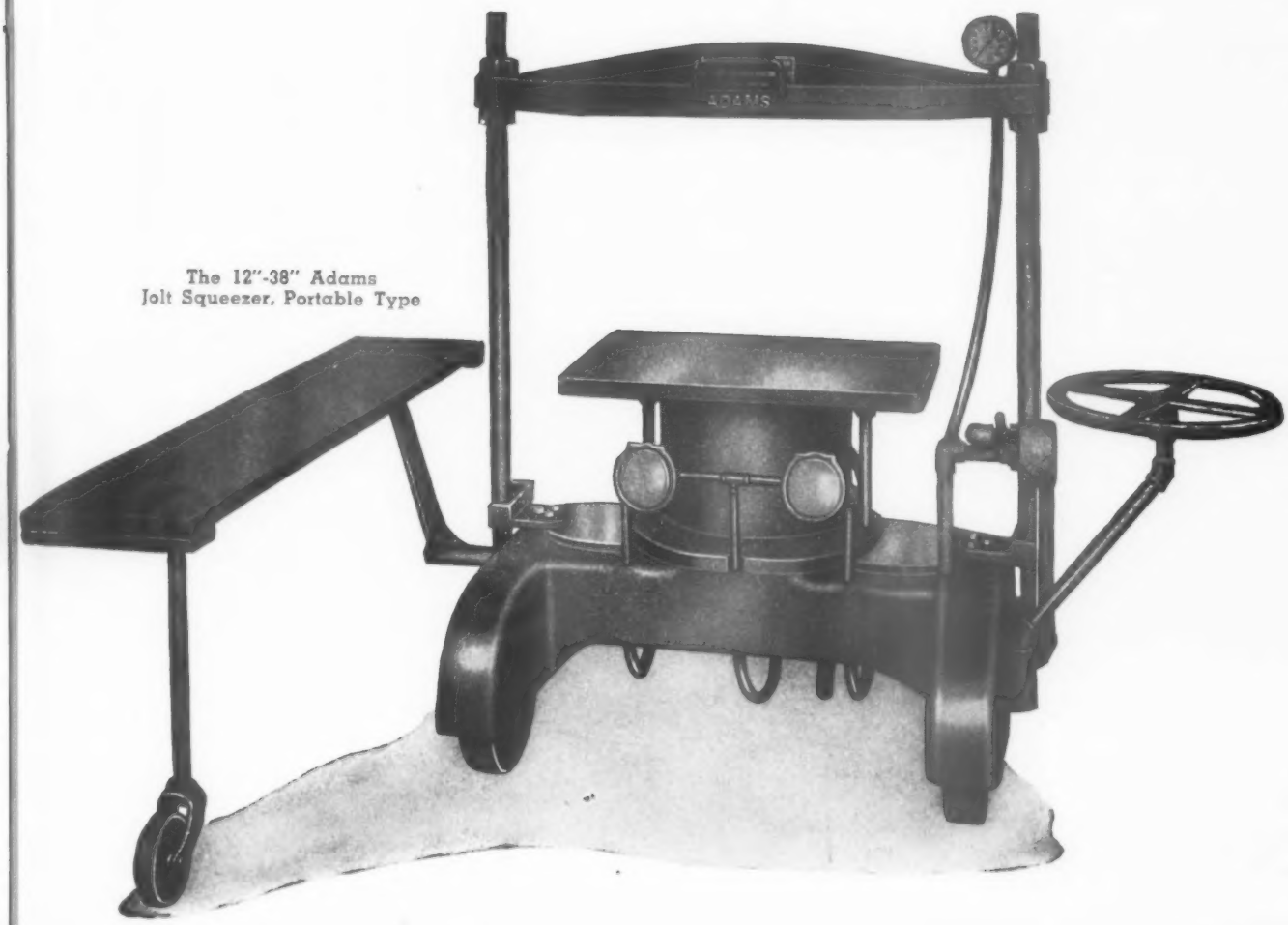

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(*Concluded from page* 155)

program.

Mr. Vennerholm spoke on "Casting Methods in Automotive Manufacture" and by the use of slides gave an exceptionally interesting portrayal of the variety of casting applications and foundry methods employed in motor car building. Casting practices, as followed by the Ford company and discussed by the speaker, included diecasting, centrifugal casting, investment mold casting, and plaster molding, in addition to the commoner types of ferrous and nonferrous casting production. In a number of instances castings have supplanted parts made previously by other fabricating methods.—*William G. Gude.*

Chicago

CHICAGO Chapter of the Non-Ferrous Founders Society held its second annual golf outing and stag party at the Medinah Country Club, Aug. 21. Two rounds of golf were featured—one at 11 a.m. and the other 2 p.m.—with dinner at 6:30 p.m. Golf and door prizes were awarded, and an after-dinner floor show completed the party.—*Jack Hodgson, Hodgson Foundry Co., Chicago.*

No. Illinois & So. Wisconsin

FOUNDRY Core Blowing" was the subject of the discussion at the Sept. 9 meeting of the Northern Illinois and Southern Wisconsin Chapter of the AFA, when 85 foundrymen assembled at Hotel Faust, Rockford, Ill. Z. Madacey, foundry superintendent, Caterpillar Tractor Co., Peoria, Ill., guest speaker, used slides to illustrate the wide range of core work and coreboxes that can be handled by coreblowers. Examples were shown of coreboxes to demonstrate positioning of venting and blowholes.

Mr. Madacey pointed out that core blowing enables the manufacturer to hold to closer tolerances on core sizes. A semiproduction coreroom can benefit greatly by use of coreblowers because one machine can be rigged to blow many and varied boxes. The speaker explained that in blowing cores the sizes of the blowholes are determined by the size of the void to be filled with sand, and vents should be plentiful but not used in excess. He stated that after considerable experience it had been found vents and blowholes can be anticipated and included in blueprints of coreboxes. There can be no set standard ratio of vents to blowholes because the path of flow of the sand varies according to contour of boxes or patterns.

It was indicated that moisture of the sand mix should be of the proper ratio to the sand so that both sand and water move through the blowholes in the same volume. For small blowers the sand should be tempered to 1.8 per cent moisture and up to 2.5 per cent moisture on large blowers. The smaller the aperture through which the sand is blown, the less moisture is required. Sand that is too dry cuts into the coreboxes considerably. Sand that is too wet blows into the box, it is true, but water is blown through first, causing the core sand to stick to the box.

Cereal binder used in coreblowing mixes prevents sticking and gives dependable baked strength. Enough cereal is added along with the oil and water, said the speaker, to obtain a green compression strength of 1.5 psi. A discussion period followed the talk.

Leader of the meeting was John T. Clausen, Greenlee Bros. & Co., Rockford, chairman of the chapter.—*Carl L. Dahlquist, Greenlee Bros. & Co.*

EFFECT OF MOLD MATERIAL ON GAS ABSORPTION

(*Continued from page* 91)

in properties, the cooling curves definitely refute this theory.

Examination of Figs. 20, 21, and the data in Tables XI and XII show that the various mold materials may be listed in the following order in respect to (1) increasing cooling rate in the mold, (2) increasing bulk water plus chemically combined water content, (3) decreasing tensile properties produced, (4) decreasing overall density obtained, and (5) decreasing soundness of the fracture of the Horizontal $\frac{5}{8}$-in. web Webbert test bars poured at 2150°F from the high-quality melt:

Increasing Cooling Rate °	Increasing Total Water Content°°° °°	Decreasing Tensile Properties °°	Decreasing Overall Density °°	Decreasing Soundness of the Fracture °°
1	1	1 (38,650 psi, 45% elongation)	1	1
2	2	3 (38,600 psi, 42% elongation)	4	3 and 5
3 and 4	4	5 (38,000* psi, *38% elongation)	3 and 5 (?)	2 and 4
5	3	4 (38,100 psi, 33% elongation)	2	—
—	5	2 (36,250 psi, 31% elongation)	—	—

° There is some doubt that high moisture content produces lower tensile properties. See Table VIII.

°° The numbers indicate different mold materials as follows: 1. Synthetic sand baked at 1700° F. 2. Synthetic sand baked at 450° F. 3. Natural green sand at 6% water, permeability 40. 4. Synthetic green sand at 3.5% water, permeability 88. 5. Natural green sand at 9% water.

°°° Includes bulk and chemically combined water.

In general, lists of the mold materials characterized by the production of an increase in cooling rate or an increase in water content are in the same order. There is also a good correlation between the tensile properties and the degree of fracture soundness. In addition, there is some correlation between the overall density and the total moisture content of the sand. In the complete absence of bulk or chemically combined water the highest densities are obtained. High bulk water, as in the green sands, produces the second highest densities; whereas, the lowest densities are obtained when bulk water is absent but chemically combined water is present. A theory accounting for this effect of water content is described later in the text.

With the exception of the castings made in synthetic green sand, there is also a good correlation in the above tabulation between the overall density of the bar and the tensile properties obtained. As noted above, the Horizontal $\frac{5}{8}$-in. web Webbert test bars made in the synthetic green sand have localized unsoundness in the shoulders of the bar, causing the fracture to occur at this location. This condition produces relatively low tensile properties and a relatively unsound fracture even though there is a high overall density.

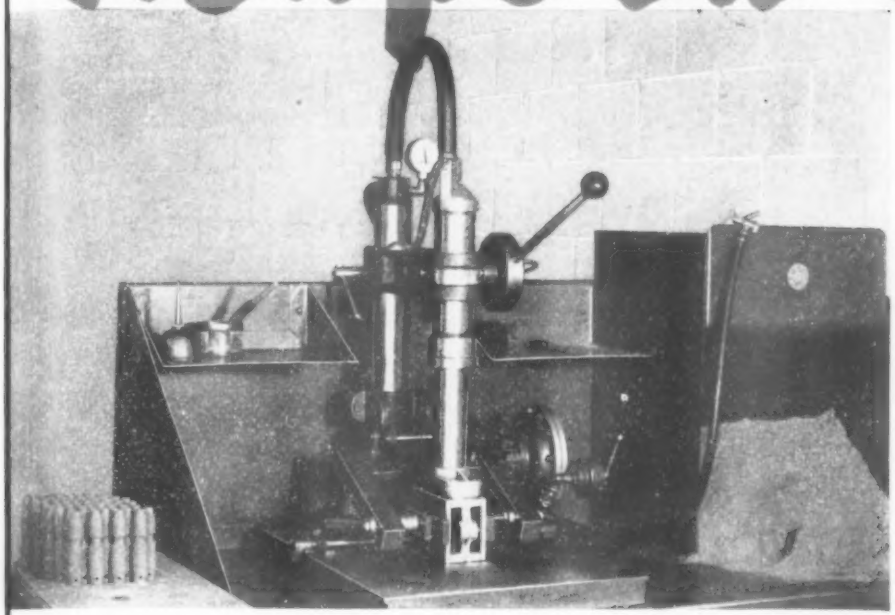
It will be observed that the above tabulation shows a fairly logical correlation among most of the test bar properties or mold characteristics listed. However, there is no logical correlation between the cooling rate on the one hand with the tensile properties, overall density, or the soundness of the fracture on the other. It is evident, therefore, that some other explanation of these effects of mold materials is required other than that proposed by Lepp and Pell-Walpole.

The higher properties and higher densities obtained on the Horizontal $\frac{5}{8}$-in. web Webbert test bar poured into green sand than is obtained in the same sand baked at 450°F is probably a result of

(*Continued on page* 158)

Redford

CORE BLOWER CARTRIDGE TYPE



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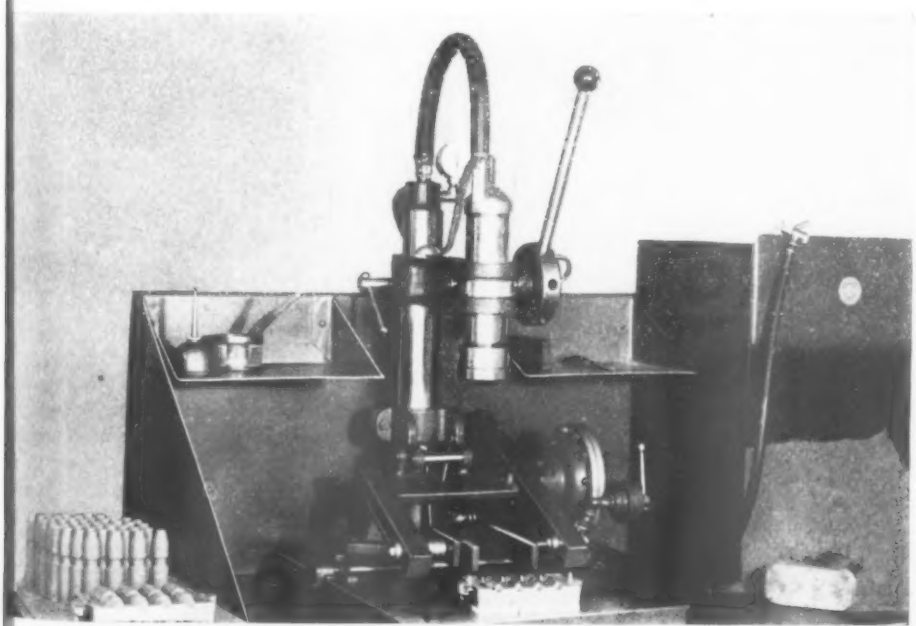

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(*Continued from page* 156)

the fact that various mold materials gas the melt in the mold cavity to varying degrees. Thus, the effect of mold material might be logically explained as follows: When a high content of bulk moisture is present, the steam generated quickly forms an oxide film on the exterior of the melt in the mold cavity. This oxide film is protective as it should prevent or retard the passage of gas, particularly hydrogen, through it. This would tend to produce a high oxygen content in the melt and a low hydrogen content. If, however, high phosphorus is present in the melt, the protective oxide skin may be reduced by the residual phosphorus, destroying it and its protective effect. It is quite possible that this is one reason that high-phosphorus alloys are more subject to gas absorption in the mold than low-phosphorus alloys, as reported by Pell-Walpole.[18]

Lower Oxygen Content a Factor

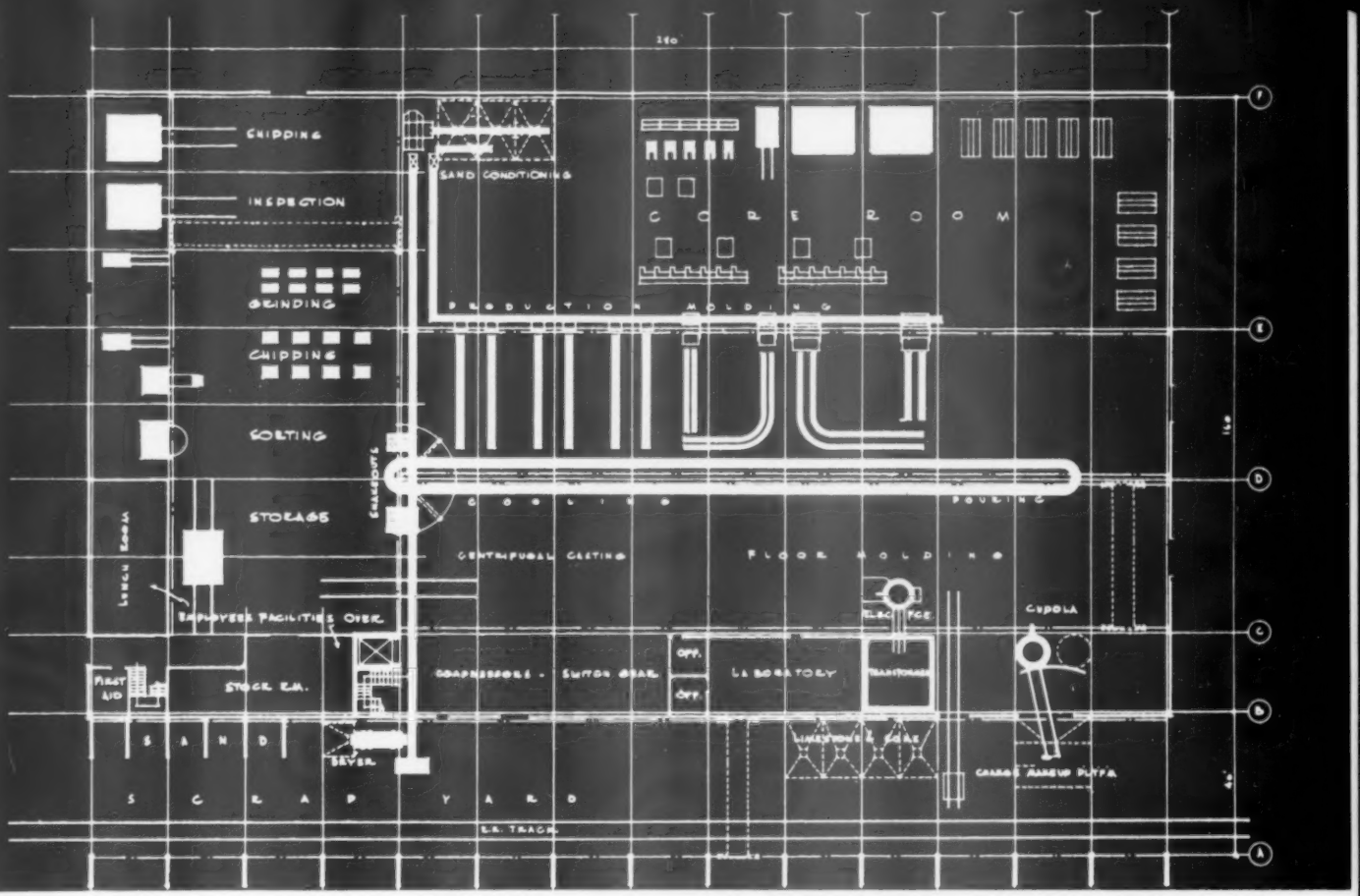
Another reason that high-phosphorus alloys are more susceptible to gas absorption is their lower maximum possible oxygen content with higher possible contents of reducing gases and gas formers as outlined previously.

In view of the data on tensile properties and density measurements, the conclusion is inescapable that the fire clay and western bentonite clay bond, baked at 450°F, is a greater source of gas than similar clay material in green sand. Furthermore, the chemically combined moisture appears to be the main source of gas, while the bulk moisture forms a protective oxide coating as previously outlined. This chemically combined moisture is removed only by a bake at a high temperature such as 1600 or 1700°F.

As illustrated by the curves in Fig. 19, and the data in Table XII, it is also evident that the amount of gas absorbed from natural green sand is greater the higher the pouring temperature. When a high-quality melt is poured into mold baked at 1600°F, the decreasing pouring temperature produces only a slight increase in tensile properties and density because the amount of evolved gas is small, and though the small amount of unsoundness resulting from gas evolution decreases slightly with decreasing pouring temperature, this small decrease can produce only a slight increase in tensile properties.

When a pouring temperature near or below 2050°F is reached, the adverse effect of the low pouring temperature on the lead distribution produces some reduction in elongation. When the same high-quality melt is poured in natural green sand, the gas absorbed from the

(*Continued on page* 160)



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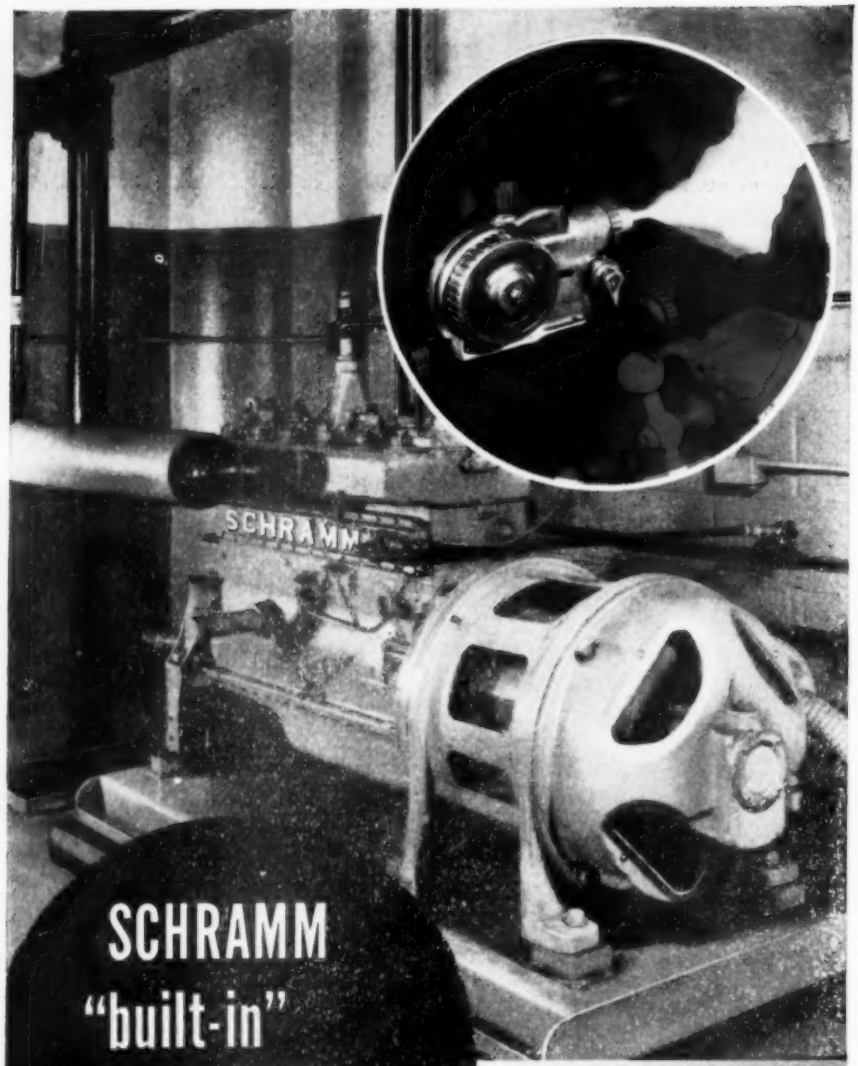

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(*Continued from page* 158)

mold at high pouring temperatures produces rather low and erratic elongation values. As the pouring temperature decreases, the gas absorption is generally less, resulting in markedly higher elongation values, but again at the low pouring temperature, the adverse effect of the less favorable lead distribution causes a decrease in elongation. When using melts of low gas content, the usual effect of pouring temperature of the tensile properties of 85-5-5-5 alloy poured into green sand molds is a marked maximum at the intermediate pouring temperatures of about 2150°F.

As illustrated in Article 5 of this series, when melts of poor quality are poured into green sand molds, there is a marked increased in tensile properties obtained with decreasing pouring temperature. This is caused by a decrease in the amount of microporosity with decreasing pouring temperature, a typical effect of pouring temperature on the unsoundness caused by a given quantity of gas evolved during the solidification of the melt. In other words, in the absence of gas absorption from the mold, the evolution of the gas or a portion of the gas in the melt in the pouring ladle has the greatest effect on the soundness and tensile properties when high pouring temperatures are employed and, therefore, the test bar properties thus obtained reflect melt quality the most reliably.

Baked Mold Most Satisfactory

It thus becomes evident that a mold material baked at 1600°F would be more suitable than natural green sand for test bars because the factor of gas absorption in the mold cavity is avoided. By avoiding this factor and holding all other variables as constant as possible, the amount of microporosity and the properties of the test bar become a direct function of the quantity of gas in the pot or pouring ladle. If natural green sand molds are employed, then a standardization of pouring temperature and mold material will minimize the variation in the amount of gas absorbed from the mold. However, it would be expected that, even though this gas absorption factor is made somewhat uniform by this practice, there would be enough variations in the amount of gas absorbed to produce variations in the test bar properties. This factor, then, probably is the most important one causing erratic test bar properties and only a fair correlation of test bar properties with the gas content of the metal in the pot or pouring laddle.

Summary—It has been shown that the highest tensile properties and the highest degree of soundness are obtained in test

(*Concluded on page* 162)

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(*Concluded from page* 160)

bars poured in synthetic sand molds baked at 1600 or 1700°F, and the next highest tensile properties are obtained in test bars poured in natural green sand. Synthetic sands bonded with oil and cereal or fire clay and western bentonite and baked at 450°F produce relatively inferior properties and the highest degree of unsoundness. Slightly higher properties and definitely higher densities are obtained in a green synthetic sand than are obtained in the same mold after baking at 450°F.

The cooling rate of castings poured into various mold materials has been investigated by means of temperature-time cooling curves. The effects of mold material studied in this investigation cannot be explained by differences, if any, in the cooling rate produced. Instead, it is probable that the bulk water in green sands tends to produce a protective oxide coating on the melt in the mold cavity which in turn reduces the amount of hydrogen that can be absorbed through this oxide film. When high phosphorus is present in the melt, the protective oxide film is probably destroyed, resulting in greater gas absorption by melts containing high phosphorus, as reported by Pell-Walpole.

In molds baked at 450°F, it is probable that the chemically combined water in the clay is the principal source of gas, and the absence of the bulk water does not permit the formation of an adequately protective oxide film. It is probable that gas absorption from the natural green sand mold, though less than that absorbed from synthetic sand molds baked at 450°F, is the principal cause of the variation in the test bar results and the generally inferior correlation of the test bar properties with the gas content of the melt in the pouring ladle.

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52. Lepp, H.: International Foundry Congress, Prague, 1933, pp. 95-118.
18. Pell-Walpole, W. T.: Foundry Trade Journal, January and February, 1946.

Conducts Southern Pig Iron Research

Southern Research Institute, Birmingham, is conducting research work sponsored by the Woodward Iron Co., Woodward, Ala., in an effort to improve the machinability of southern pig iron by eliminating the adverse effects of its phosphorus content in certain operations such as those involving the machining of castings at high cutting speeds on semiautomatic machines. Goal of the work is the broadening of markets for southern pig iron to the automotive and machine tool industries.

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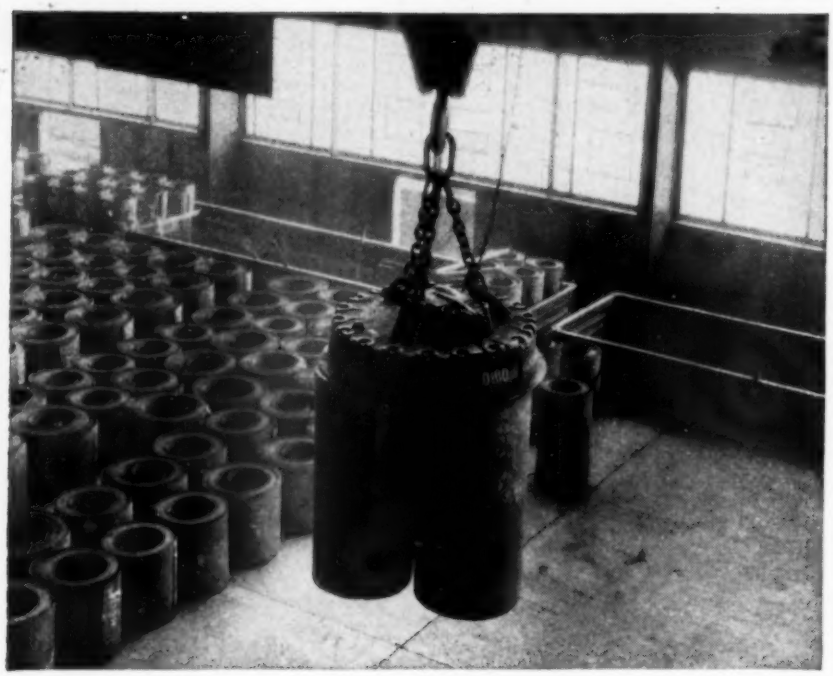

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SAND CONTROL

(*Continued from page* 97)

pick a combination of clays that will give the desired finish with the proper grain size and put durability second and not first when deciding upon the type of clay to be used. However, when it comes to the cost, it will take approximately twice as much fireclay by weight to produce a pound of green compression strength as bentonite, which is possibly the least durable of all synthetic bonds.

There are two distinct types of bentonite, known as western and southern bentonite. Western bentonite has high dry strength, high hot strength and high deformation. Southern bentonite has low dry strength and low hot strength and deformation. To the practical foundryman, this means that a study must be made of the clays and selection made according to requirements on casting finish and the defects brought on by these various types of clay.

Describes Results Obtained

In order to stay away from an expansion defect we must have deformation from .018 to .024-in. This is hard to obtain with straight southern bentonite and unless the green compression strength is excessive, say 14 to 16 psi, there is apt to be expansion trouble, such as rat tails, buckles and buckle scabs. When all western bentonite is used and the deformation is high, there is trouble with metal penetration, but very little expansion trouble. With the western bentonite there is less possibility of cuts and washes at the gate due to its high dry and hot strength, whereas in southern bentonite we will run into these two troubles because of its inherent properties of low dry strength and low hot strength.

In using the western bentonite the sand has a tendency to be lumpy and hard to shake out. This again is due to high dry strength, while with the southern bentonite with the physical properties of low dry strength and low hot strength, means easy shake out and sand free from lumps. The kaolinite clay is generally a harsh bond that is durable, but it has the same characteristics as western bentonite with high hot strength and high dry strength.

In looking at these various clays, common sense would tell us to combine the clays so that there is sufficient hot and dry strength to prevent cutting and washing at the gates, but not enough to give serious shakeout troubles. This will promote the best flowability of the sand and give the best finish.

Nothing has been said up to this point

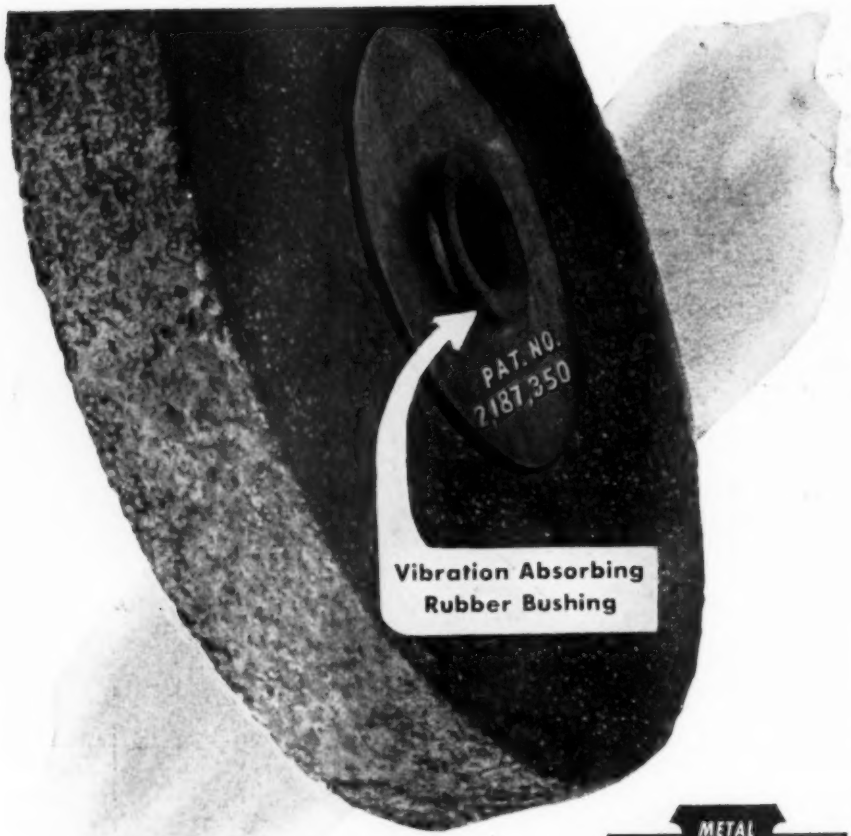
(*Continued on page* 166)

WHAT THEY DO FOR YOU • For the fast and accurate line-up of cope and drag that means speedier production of quality castings, it will pay you to use Universal Press Fit Flask Pins and Bushings. Once you install them on your flasks you can count on perfect register of cope and drag for hundreds of castings, for these pins and bushings are precision machined, hardened, and ground for lasting accuracy.

HOW THEY ARE USED • A round and an elongated bushing are pressed into opposite ends of the cope flask. These receive the pins which are pressed into corresponding positions in the drag flask. The elongated bushing which receives a round pin assures positive alignment and permits longitudinal expansion caused by the heat of heavy metal sections. To insure fast, easy flask assembly on the production line, cope flask bushings are guided to the drag flask pins over a tapered, loose-fitting closing pin which is removed after the assembling is completed. Ground leads on both pins and bushings aid further in easy, accurate assembling. Pins and bushings of oversize O.D. can be supplied to compensate for wear in the press fit holes.

Universal Press Fit and Taper Flask Pins and Bushings are available in several sizes for use in cast iron, steel, and aluminum flasks. Special sizes and types made to order. Write for complete particulars.

Universal ENGINEERING CO. • FRANKENMUTH, MICH.



METAL SHOW CHICAGO Oct. 18-24
VISIT OUR EXHIBIT BOOTH No. 1215

"Floating Power"

for PORTABLE GRINDERS

because MANHATTAN V.D.B. WHEELS have the patented VIBRATION DAMPENER BUSHING

Men like them because they reduce fatigue and strain. Freed from the tiresome vibration, chatter or jumping of the grinder in their hands, operators guide the wheels with greater accuracy. More work is done with less effort.

With a Manhattan Vibration Dampener Bushing dissipating wear and tear, you find the wheel lasts longer and the machine lasts longer, too. Maintenance costs go down and the shop shows a better profit.

. . . Big results from a little thing like a vibration absorbing rubber bushing, but a trial and comparison proves how savings are accumulating for present users.

The Manhattan V.D.B. Bushing and Wheel are sold as a unit in straight types up to 8" in diameter. Sold direct by the

ABRASIVE WHEEL DEPARTMENT

RAYBESTOS-MANHATTAN INC.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION PASSAIC, NEW JERSEY

(*Continued from page 164*)

on the permeability involved to make various cross sections of castings. With the grain size properly selected and controlled there will be very little trouble in maintaining high permeability. In foundries where grain size control is practiced and 70 per cent of the grains are on the 100 and 140 mesh screens, a combination of either western and southern bentonite plus some natural bond, or kaolinite and southern bentonite plus a natural bond, will maintain the permeability at 60 to 80, yet a fine finish will be obtained for jobbing and machine tool castings. Sand with a grain size classified on the 100 and 140 mesh, making stoveplate primarily, employing southern bentonite and natural bond, will maintain a permeability of 50 to 60 and give an excellent stoveplate finish with mechanical ramming.

Segregate Natural Bonds

When studying natural bonds by the districts in which they are produced, they can be segregated as well as the synthetic clays according to dry strength and hot strength. Their green strength is somewhat of an indication of their durability. A naturally bonded sand with approximately 20 per cent clay, showing a green strength of from 12 to 16 psi will generally show the clay as being not too durable, but again durability is not the only thing we are after when we select a molding sand. If the natural sand has a good grain distribution, with low pan material, it lends itself to rebonding without balling, whereas a naturally bonded sand, with high pan material, does not lend itself to rebonding without balling.

Type of mixing equipment must also be considered when determining the green compression strength at which the foundry can operate. Where there is a mulled facing and good mechanical equipment, such as sand cutters and aerators, a green compression strength can be maintained in the facing from 8 to 9 psi and maintain the heaps at 6 to 7 psi. In order to maintain a heap at 6 to 7 psi with naturally bonded sand, it becomes necessary to add some bond if there is any amount of core sand returning to the heaps, because if too high a bonded natural sand is selected, it is impossible to distribute this clay uniformly over all the grains unless it is mulled thoroughly. In mechanical shops where all sand is mulled, it is possible to operate successfully with the strength maintained as high as 10 to 12 psi, providing we have the proper flowability and deformation with this high strength sand.

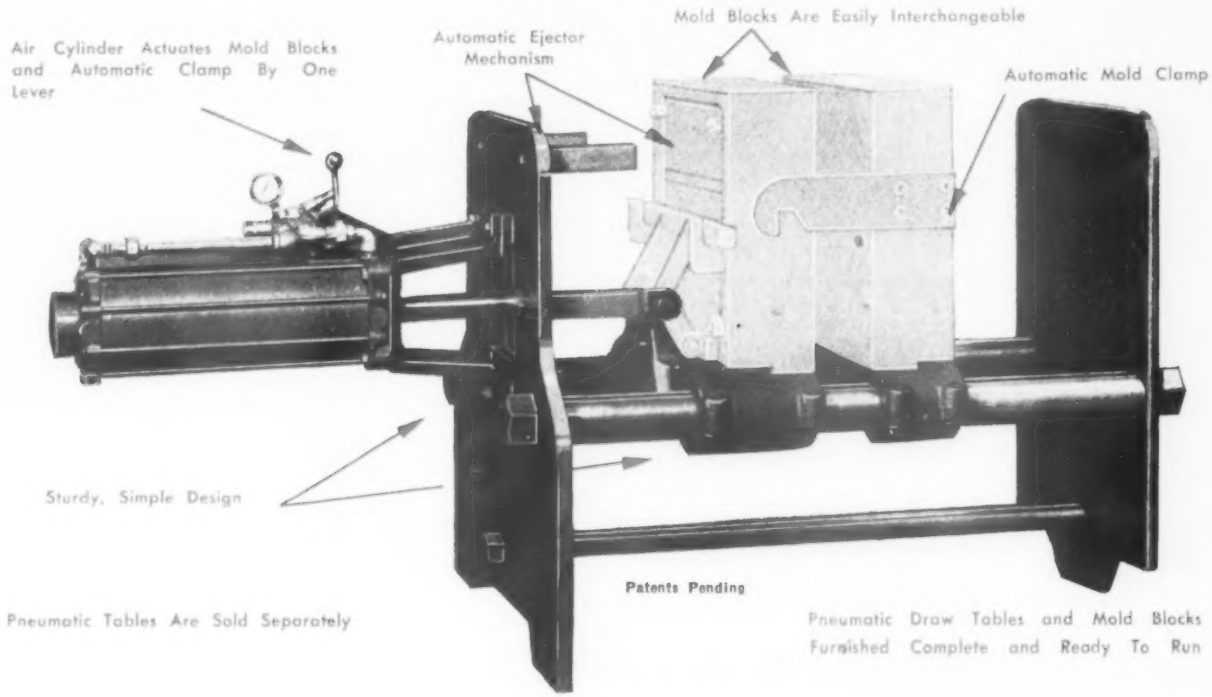
The next thing to control and this is usually very poorly done in the average

(*Continued on page 168*)

Keep in Step with the Latest Trend in

PERMANENT MOLDS

for Aluminum Castings


Air Cylinder Actuates Mold Blocks and Automatic Clamp By One Lever
Automatic Ejector Mechanism
Mold Blocks Are Easily Interchangeable
Automatic Mold Clamp
Sturdy, Simple Design
Patents Pending
Pneumatic Tables Are Sold Separately
Pneumatic Draw Tables and Mold Blocks Furnished Complete and Ready To Run

Permanent molds of the manually operated type give you increased production at lower costs, improved casting quality, smoother and more attractive castings, closer dimensional tolerances and castings that require less polishing and machining.

Air operated molds save additional time and money and still give you the same advantages. Mold cavity blocks accommodating castings up to 10" in size are easily interchangeable. Larger tables and mold cavity blocks are also available. The simple and durable design enables ease of operation and requires very little upkeep. In addition, this time and effort saving pneumatic table permits constant use. Inquire now for future production requirements.

It is of utmost importance to have your mold blocks for both manually operated and air operated molds accurately and properly designed to suit the requirements of your foundry and to enable them to produce aluminum castings with a minimum amount of effort. Expenses incurred in the initial cost of this type of PROVEN AND DEPENDABLE mold equipment are quickly amortized in more efficient production.

SEND US YOUR BLUEPRINTS OR SAMPLE CASTINGS FOR QUOTATION.
YOUR INQUIRY WILL RECEIVE OUR IMMEDIATE ATTENTION.

MASTER PATTERN COMPANY

1315 MAIN AVENUE — CLEVELAND 13, OHIO

DESIGNERS AND MANUFACTURERS OF PERMANENT MOLDS, WOOD AND METAL PATTERNS AND MODELS

To STOP "burning in" . . .
NOTE THIS TRIAL OFFER
Introducing you to the merits of
MOLDUKO
(TRADE MARK REGISTERED)

A PATENTED CORE AND MOLD PROCESS FOR ALL METALS

A LONG LIST OF FOUNDRIES HAVE BEEN USING IT FOR YEARS

We are now in a position to supply Molduko to new users and would like, therefore, to have YOU try it on the work you are doing now. Primarily intended for use on dry sand cores and molds to produce *extremely smooth surfaces,* Molduko also has an application to certain green sand molds and chills. Available in types for steel, gray iron, brass and bronze work, it effects pronounced savings in cleaning and inspection costs. As one of our foundryman-customers puts it, ". . we find Molduko far superior . . . . "

WRITE FOR DESCRIPTIVE BULLETIN "F"

TRIAL OFFER: If you will advise the type of work you are doing, troubles you are having and approximate weekly production, we'll be glad to send you a working sample consisting of a 10 gallon combination of liquid and special filler, to be billed at the full-drum price.

MOLDUKO Processed Core Used — Untreated Core Used

Both of these Castings Poured from same crucible.

SUPERFLAKE GRAPHITE PRODUCTS

SUPERIOR FLAKE GRAPHITE COMPANY

Manufacturers of mold and core washes, facings, parting compounds, core paste, carbon-raiser.

TELEPHONE: RANDOLPH 7939

33 So. Clark Street — *Chicago (3) Ill.*

(*Continued from page* 166)

jobbing shop, is the moisture content. We often hear the question "what is the proper moisture?" The proper moisture is the point at which the best physical properties can be obtained for all factors, including permeability, green compression, dry compression, hot strength and deformation. This point is called the optimum moisture and will vary with each type of clay and all combinations of clay, so the only way this question can be satisfactorily answered for your own shop is to test the sand at the varying moistures and check these various properties.

No one can tell you to operate at 3, 5 or 8 per cent. That will depend entirely upon the curve obtained when plotting these various physical properties. However, you have a good combination of clay when the physical properties will remain fairly constant over the widest range, say plus or minus 1 per cent from a given point of moisture. This will give you a little insurance against blows, scabs, etc. Where sand is handled in a unit, this property can be fairly well controlled.

Study Three Main Factors

In a jobbing shop it can also be controlled if a study of three main factors is made and taken into consideration, namely, metal temperature, total weight of the metal poured, and the time. For light gray iron shops and stoveplate, approximately 2 gal of water are evaporated to every 100 lb of metal poured, where the castings remain in the sand for 2 hr before shaking out. This practice was taken from a stove shop that added 1 gal of water for every hand ladle poured. Their shakeout time was approximately 2 hr after pouring, with a metal temperature of about 2650 to 2700°F. Then the water was metered onto the floor with a hose.

The control was relatively simple—each molder marked on a bottom board with a piece of chalk the number of full ladles poured on his floor and that in turn determined the number of gallons of water added that night. If for some reason the shakeout was slow, the water was increased 1 qt for every half hour over the 2 hr. This worked out very satisfactorily and the moisture was controlled between 6½ and 7½ per cent, which was their working range with the type of clay involved. These figures may not fit your particular case 100 per cent, but will give you a good point to start from if you are now adding it by guess.

In light gray iron work, such as stoveplate and light jobbing work, we do not find it necessary to use any other material to get good sand control and castings free from defects. However, if we

(*Continued on page* 170)

FABREEKA

UNDER SHAKEOUT MACHINES
JOLT MOULDERS AND
OTHER HEAVY MACHINERY

FABREEKA has demonstrated its ability to increase production efficiency and reduce the costs of maintenance by absorbing the effects of heavy impact shock and destructive vibration under such heavy machinery as shakeout machines, jolt moulders, forging hammers, grinders, stamping machines and many others.

Write for engineering data and latest catalog.

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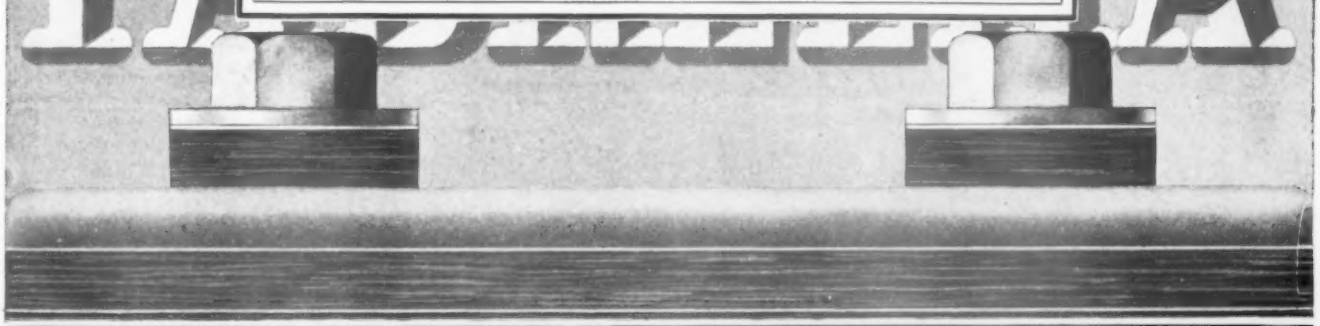
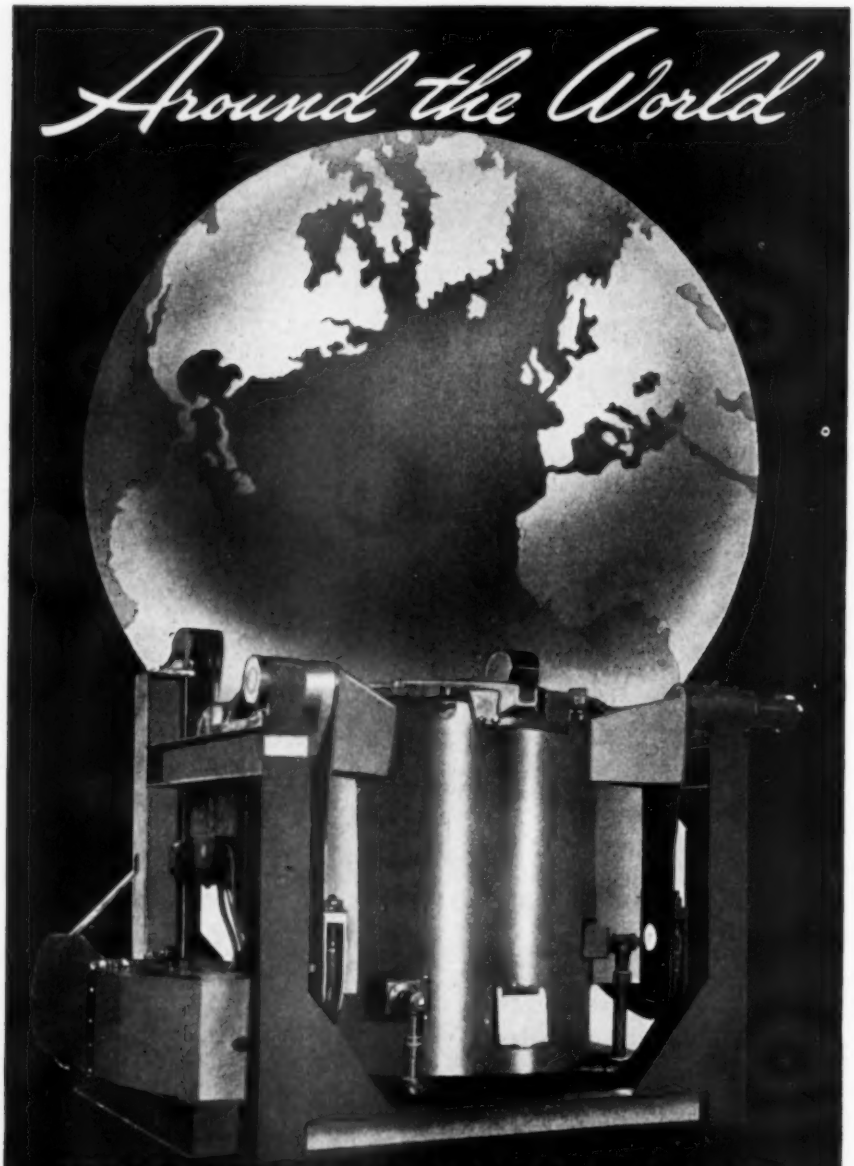


for IMPACT SHOCK and VIBRATION



WHERE EFFICIENT MELTING OF NON-FERROUS METALS IS REQUIRED

HAUSFELD FURNACES ARE DOING THE JOB

FURNACES FOR
BRASS • ALUMINUM • MAGNESIUM
AND ALL OTHER
NON-FERROUS ALLOYS

The Campbell-Hausfeld Co.
300-320 MOORE ST. HARRISON, OHIO

(*Continued from page* 168)

get into heavier metal sections it becomes necessary in green sand work to add some material that will help the sand peel from the casting, most generally seacoal. When grain size control is practiced it is again necessary to select a seacoal with approximately the same grain distribution as the molding sand.

In this way we again prevent getting into a wide spread screen analysis and lowering the permeability due to filling in the void spaces between our uniform grain. I have been criticized at times for recommending seacoal with grain classification. However, when we consider that the seacoal is usually introduced through a facing sand and then returned to the heap being only partially burned out, we must be very careful that the backing sand is not closed up and have less permeability than there is in the facing sand, otherwise we have to go back to stick venting the backing sand in order to stay away from blows and low permeability scabs. This is an unnecessary operation, time consuming and very inaccurate and undependable unless we have an exceptionally skilled molder.

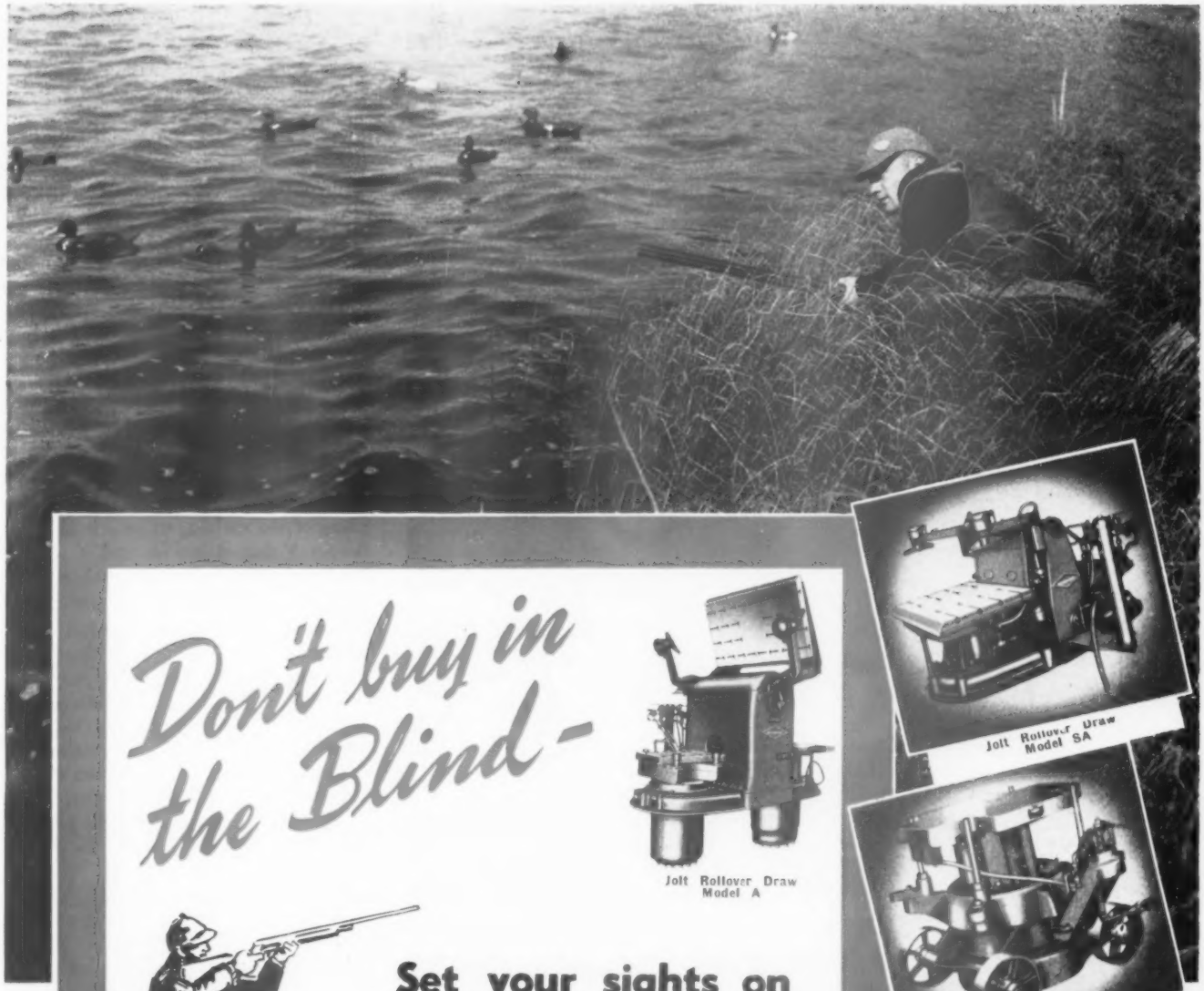
Control Expansion Trouble

In controlling expansion trouble, which occurs more frequently with a concentrated grain, seacoal also helps in this respect in that as the temperature increases on the surface of the mold, the seacoal becomes soft and leaves room for the grain to expand. Seacoal reduces cutting and washing at the gates by coking at still higher temperatures and building up the hot strength. If we have a large flat surface to make, it is also desirable to add some form of cereal binder. This can be wheat flour, corn flour, wheat or rye middlings. There is also on the market today finely ground wood flour, which helps offset expansion defects. After the grain size control is established, then by watching the castings and working on whatever defect there may be, it is a simple matter to change the sand to offset such defects.

If there are cuts and washes at the gates, it is necessary to check to see that the gating is properly designed and determine that the casting is gated in such a manner that the metal flows into the casting without any turbulence or squirting action. If this is found to be satisfactory we should then increase both the dry and hot strength of the sand. To do this we can add either western bentonite or a kaolinite clay and reduce either the natural bond, or southern bentonite so that we maintain the same green compression strength and yet raise the dry compression and hot strength.

If trouble is experienced with cracked castings, hard shakeout and lumpy sand,

(*Concluded on page* 172)



Don't buy in the Blind-

Jolt Rollover Draw
Model A

Set your sights on a "DAVENPORT"

Shooting
birds on the wing is great sport

BUT foundry production must be a "Sure Hit".

Eliminate all chance and write today for a "Davenport" catalog. It illustrates the foundry molding machine that assures unlimited production.

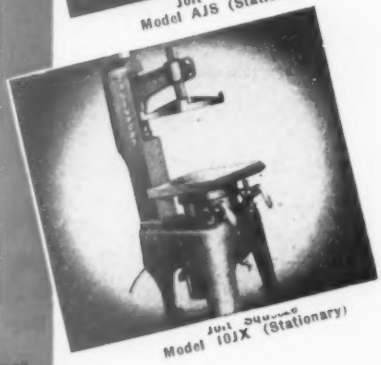
DAVENPORT MACHINE AND *Foundry Company*
DAVENPORT IOWA U.S.A.

Canadian Representatives: Canadian Foundry Supplies & Equipment Ltd., Toronto and Montreal

Jolt Rollover Draw
Model SA

Jolt Pin Lift
Model AJS—(portable)

Jolt Pin Lift
Model AJS (Stationary)



Jolt Squeeze
Model 10JX (Stationary)

IT HAS A LONGER-LIFE LINER

The boron carbide liner — made from the strongest, hardest, most abrasive-resisting substance ever made for commercial use — accounts for the longer service life of the Pangborn-Norbide* Nozzle. 1500 hours *guaranteed* when used with metal abrasive.

Air consumption is reduced 10 to 20% as compared with iron nozzles and blasting efficiency is improved because stream contour and abrasive velocity are maintained.

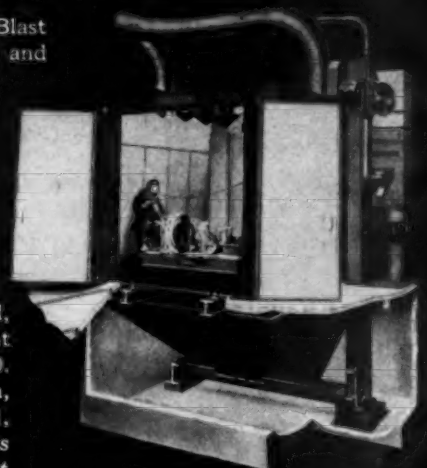
No other nozzle will out-perform a Pangborn-Norbide. Pangborn Corporation, 1300 Pangborn Boulevard, Hagerstown, Maryland.

*Trademark of Norton Co. for boron carbide

FEEDS AND CLEANS ABRASIVE MECHANICALLY, HYGIENICALLY

The success of the Pangborn Blast Cleaning Room in speeding up and lowering the cost of blast cleaning is due in major part to Pangborn's development of the Mechanical System of Abrasive Recovery.

Replacing hand work, the System — by stratification and pneumatic treatment — separates good abrasive from dust, fines and coarse material, and returns it to the Blast Machine. Write for Catalog 400. Address Pangborn Corporation, 1300 Pangborn Boulevard, Hagerstown, Maryland—*world's largest manufacturer of blast cleaning and dust control equipment.*



Pangborn

Pangborn Corporation Hagerstown, Maryland

BLAST CLEANS CHEAPER

WITH THE RIGHT EQUIPMENT FOR EVERY JOB

(*Concluded from page* 170)

decrease the amount of western bentonite or kaolinite and add southern bentonite or a natural bonded sand with lower dry and hot strengths. If there are expansion troubles, such as rat tails, buckles or buckle scabs, then we must increase our deformation; to do this cereal is generally used, seacoal increased, western bentonite or wood flour added. In this instance we must be sure we can tell the difference between an erosion scab or low permeability scab and an expansion scab.

The expansion scab is readily identified due to the fact that there is always a layer of sand trapped between the scab and the original mold surface of the casting. An expansion scab is a severe condition of a rat tail and buckle. A rat tail is an offset in the level or surface plane of the casting, while a buckle is a deeper V-shaped groove and if not noticed before cleaning, the scab may be knocked off in the cleaning operation.

An erosion scab can be caused by excessively hard ramming even though the permeability and strength are proper for the cross section involved. An erosion scab occurs where the metal has been agitated, has boiled or has partially eroded the sand, leaving a solid mass of sand and metal at that particular spot. Some of the sand that was eroded generally finds its way to the cope of the casting as dirt or inclusions.

In conclusion, when sand control is practiced we use our sand tests as a guide to tell us what to add to a properly selected base grain in order to stay away from casting defects which mean scrap castings or costly salvage operations. There are too many shops today testing sand, but failing to have sand control because they lack a proper knowledge of the ingredients of the major components of the material which they are using.

Editor's Note: This paper was presented before the Chicago Regional Foundry Conference, Nov. 22, 1946.

Portable Grinding Machines

Grinding Wheel Manufacturers Association, 27 Elm St., Worcester 8, Mass., has published a 20-page booklet, "Portable Grinding Machines—Safe and Efficient Operation," one of a series being issued by its safety committee. Fully illustrated to show correct and incorrect methods of mounting grinding wheels on portable machines, the booklet discusses means of avoiding wheel breakage, high and low speed machines, protective devices and methods, and provides tables for conversion of rpm to surface fpm for wheels 1 to 8 in. in diameter.

top charging cuts costs . . .

on

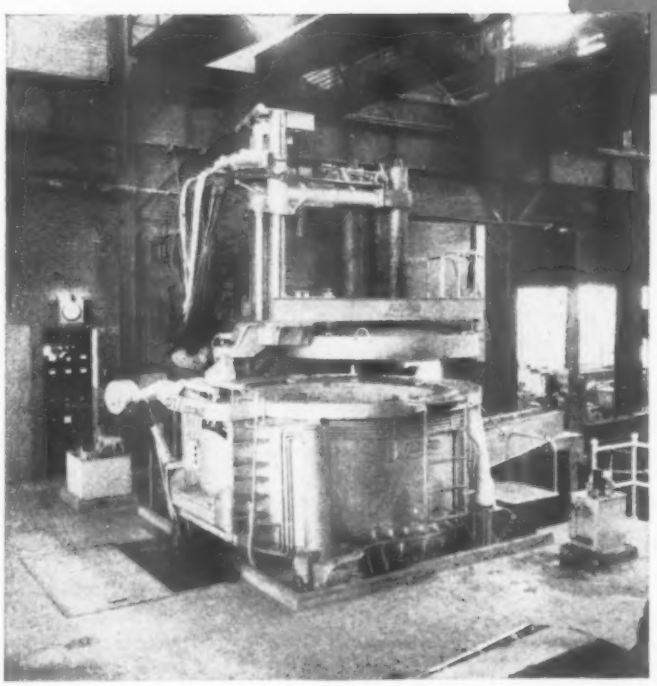
- operation
- maintenance
- materials

with

MOORE RAPID

Lectromelt

FURNACES



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France	Stein et Roubaix, Paris
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Belgium	S. A. Belge Stein et Roubaix, Bressoux-Liege

Years of constant use by more than a thousand users have proved that Lectromelt furnaces cut metal melting costs substantially. Here's how:

OPERATION

Top charging reduces down time, allows more actual time in furnace use. Electrode consumption per ton is substantially less for a top charge Lectromelt, and power consumption is also lowered.

MAINTENANCE

Lectromelt top charge furnaces eliminate serious strain on roof refractories and superstructure, lengthen refractory life and reduce the per-ton repair charges.

MATERIALS

Lectromelt top charge furnaces are ideally suited for using a wide variety of scrap—such as borings, turnings, trimmings, flashings and shear scrap—which is ordinarily lower priced than other types.

Detailed information will be sent upon request. Lectromelt furnaces are available in capacities ranging from one-quarter to 100 tons.

PITTSBURGH LECTROMELT FURNACE CORP.

PITTSBURGH 30, PA.

Industry BRIEFS

MERGER of Lima Locomotive Works Inc., South Main St., Lima, O., and General Machinery Corp., 545 North Third St., Hamilton, O., has been authorized by the respective boards of directors. New company will be known as the Lima-Hamilton Corp. It is contemplated that Samuel G. Allen and John Edison, chairman of the board and president, respectively, of Lima Locomotive Works, will hold the same positions in the new corporation, and that George A. Rentschler, chairman of General Machinery Corp., will be the new company's executive committee chairman.

• • •

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y., has received preliminary notification that its bid for a part of Plancor 168T, formerly operated by Bell Aircraft Corp., has been accepted. Property inculdes 65 acres and four buildings with a total floor area of 290,000 sq ft. It will be converted into manufacturing space for Carborundum's coated abrasives division. The company also has completed negotiations for the acquisition of land as a site for an extensive furnace plant at Vancouver, Wash.

• • •

Amoskeag Steel Corp., Manchester, N. H., newly organized steel foundry, will have a capacity of 3 to 4 tons of steel castings hourly, according to Nathan C. Harrison, president and chairman of the board. Mr. Harrison is also president of Harrison Abrasives Corp., Manchester. Also on the board of directors of the new company are Harry L. Additon, president, Merchants National Bank, Manchester; Samuel P. Hunt; William O. Faxon, vice president and general manager, Harrison Abrasives Corp., and Joseph Prendergast, who will be vice president and general manager of the new corporation which is located in the old Amoskeag electric plant building.

• • •

Smith Falls Malleable Castings Ltd., Smith Falls, Ont., destroyed by fire in April, plans to rebuild its plant following reorganization of the company, and be back in full production soon. Thomas Arnold, well known in the foundry industry and Machine Tool Controller for Canada during the war, has been made the new president. George B. Frost, son of the founder of the company, is vice president and plant manager, and F. O. Peterson, secretary-treasurer.

• • •

Bond Foundry Corp., Decatur, Ill., has been incorporated by O. E. Bond who recently purchased the foundry of the Faries Mfg. Co., 1036 East Grand Ave., Decatur. Mr. Bond formerly was general manager of Model Brass Co., Decatur. Board of director members in Bond Foundry are Mr. Bond, D. S. McGaughey Jr., and George Reese.

• • •

Magnus Metal Division of the National Lead Co., Chicago, has purchased the real estate and property of Prairie Brass & Metal Co., subsidiary of American Smelting & Refining Co., 1711 Cherry St., Kansas City, Mo. Company makes bronze and brass castings of journal bearings for railroad cars and steam locomotives. Norman Chivvis, a vice president of the Prairie and American firms, remains with the National Lead Co. unit as manager.

• • •

National Farm Machinery Co-operative, Ohio Cultivator Division, 1930 Ohio St., Bellevue, O., plans construction of a $500,000 gray iron foundry scheduled for completion July 1, 1948. It is planned to be one of the most modern foundries in that section of Ohio, and to incorporate overhead sand and automatic shakeout.

• • •

Hickman, Williams & Co. has been appointed sales distributor for shot and grit produced by Western Metal Abrasive Co., Chicago Heights, Ill. This arrangement will facilitate delivery of metal abrasives to customers in Chicago, St. Louis and farther west. Hickman, Williams & Co. also will continue as distributors for shot and grit manufactured by the National Metal Abrasive Co., Cleveland.

• • •

Progressive Welder Co., 3050 East Outer Dr., Detroit 12, has acquired the Warren Alloy & Machine Co. which has been operating a nonferrous foundry in Warren, Mich., and a jig, fixture, die, gage and punching unit plant in Detroit. Both plants will be operated as a separate division of Progressive Welder Co. under the name of Warren Alloy & Machine Division.

• • •

Lapeer Mfg. Co., Lapeer, Mich., has taken over Knu-Vise Inc., Detroit, and the manufacture of that company's toggle-action clamping devices, which will continue to be known as Knu-Vise products. Knu-Vise executives will assume management of the new company, and the sales office will remain at 2208 Eighth St., Detroit.

• • •

George King Co. Inc., Sheffield, Ala., producer of iron and steel castings has been acquired by Sheffield Iron & Steel Co., subsidiary of Barium Steel Corp., New York. S. T. Jazwinski, vice president of Sheffield Iron & Steel Co., has been appointed manager of the foundry.

• • •

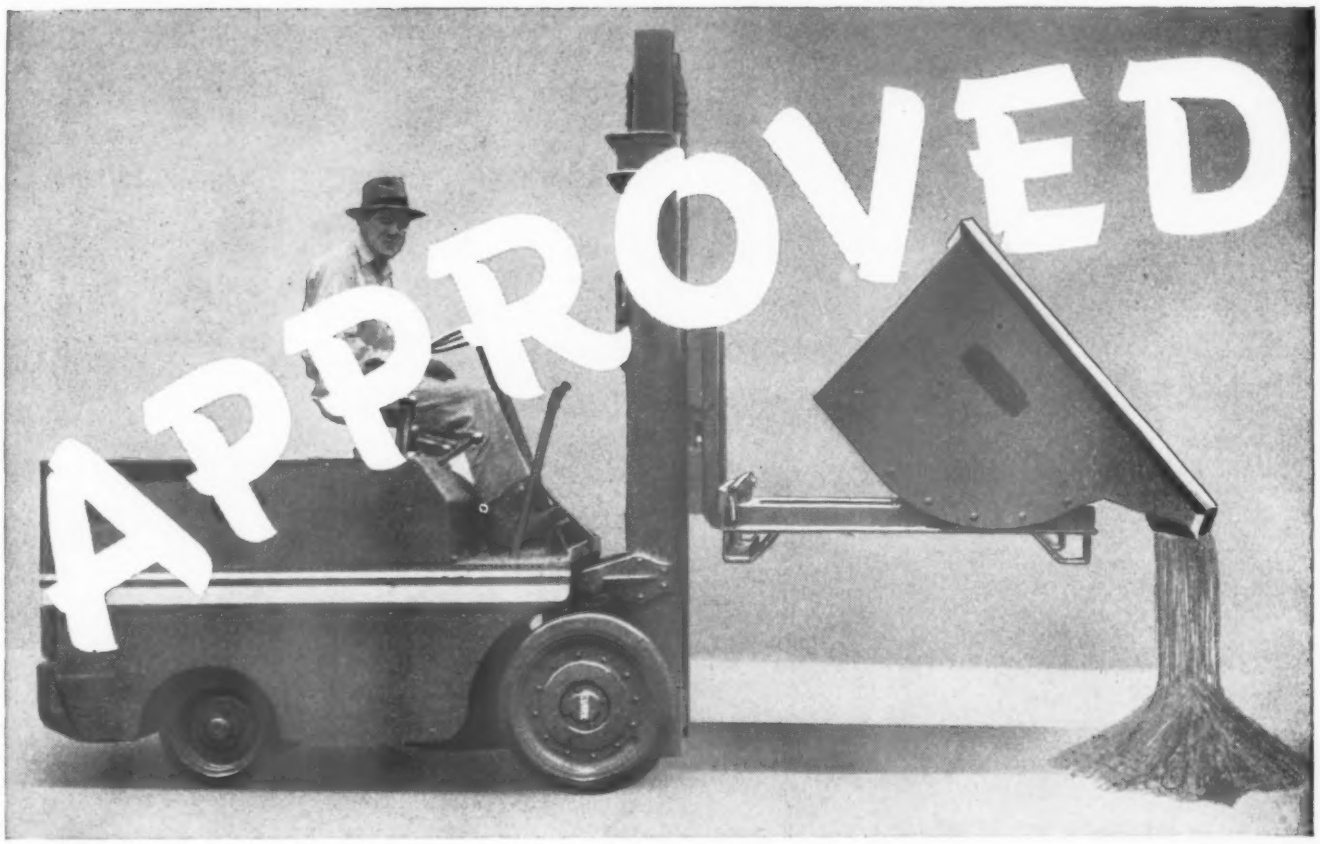
East Columbus Brass & Aluminum Co., Columbus, Ind., has completed and equipped a new coreroom and has expanded its casting facilities.

• • •

American Radiator & Standard Sanitary Corp., 1541 South Seventh St., Louisville, has launched a program to completely revamp, mechanize and mod-

(*Continued on page* 179)

NATIONAL BEARING DIVISION, American Brake Shoe Co., is completing this new plant, shown here in course of construction, at Meadville, Pa. Measuring 261 x 735 ft, the $2,500,000 plant will include foundry, pattern shop, coreroom and machine shop, and will be modern in all respects. Two cupolas and 25 other types of furnaces will be used to melt bronze for production of various size bearings



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ROURA SELF-DUMPING HOPPERS!

No slow, tiring hand work. Automatically dumps, levels and relocks. Only one simple manual operation.

Because THEY SAVE MONEY by doing every type of bulk handling job you have . . . REDUCE FATIGUE 50% and save time with PERFECT SAFETY—leading industries throughout the country use ROURA Self-Dumping HOPPERS.

Handle any bulk material in your plant . . . hot, cold, wet or dry . . . without slow hand transferring fatigue slow-down, danger of injury from excessive lifting or dropping.

STANDARD (1 cu. yd.) MODEL $100.00 . . . F. O. B. Detroit
Write for NEW DETAILED BULLETIN today.

Fits any standard fork or platform type lift truck. Sturdily balanced for carrying and dumping.

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IN SHIPS

Better Methods! The modern ocean liner crosses the Atlantic in a few days compared to the sailing vessel's voyage of many months. Today's ships are not only faster, but larger and safer.

SANDSLINGER — BETTER METHODS

IN SAND RAMMING

Better Methods! The Sandslinger thoroughly and uniformly rams 700 to 2000 pounds of sand per minute—doing a job in minutes that formerly required hours or days with hard labor, shoveling and hand ramming.

12 TYPES

of SANDSLINGERS to meet the requirements of ALL foundries

LARGE — SMALL
OLD — NEW

The 9 types of Stationary Sandslingers and Speedslingers with manually, power or automatically directed ramming of 7 to 20 cu. ft. of prepared sand per minute, offer adaptation to an unlimited number of conditions in foundries, large or small.

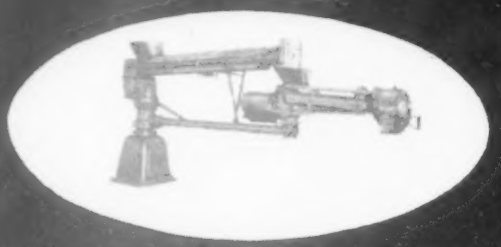
The Tractor Type Sandslinger rams molds from production or semi-production pattern equipment on molding floors not served by a sand handling unit. The Tractor Type Sandslinger prepares, conveys and rams 7 to 10 cu. ft. of sand per minute.

The Motive Jr. Sandslinger is the accepted method for ramming all types of floor and pit molds on the jobbing or miscellaneous foundry floor. The Motive Jr. rams 7 to 10 cu. ft. of sand per minute.

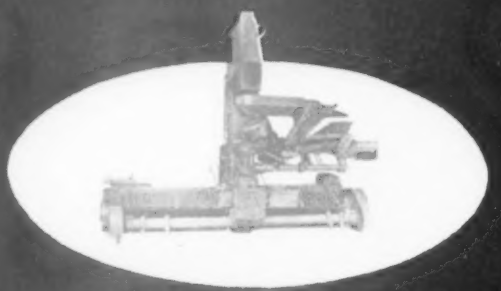
The Motive Speedslinger is the ultimate in capacity for floor and pit mold ramming. The hydraulically controlled movement of the ramming head affords maximum flexibility and virtually effortless ramming of 20 cu. ft. of sand per minute.

You can see any one of the Sandslingers below in operation.

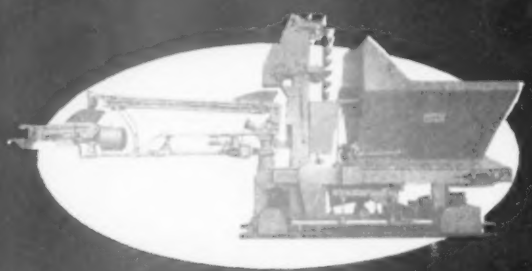
We will make complete arrangements for a demonstration in a foundry located near you.



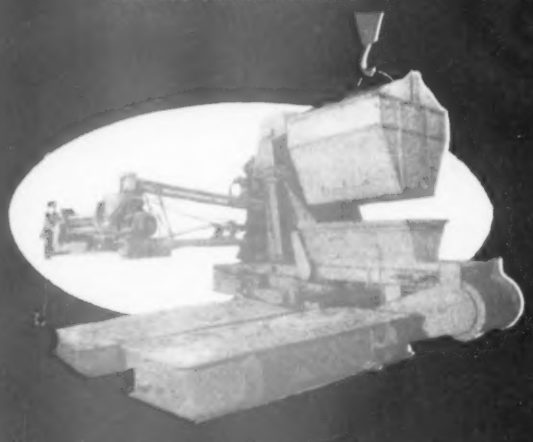
DOUBLE BELT STATIONARY TYPE SANDSLINGER



TRACTOR TYPE SANDSLINGER



MOTIVE JR. SANDSLINGER



MOTIVE SPEEDSLINGER

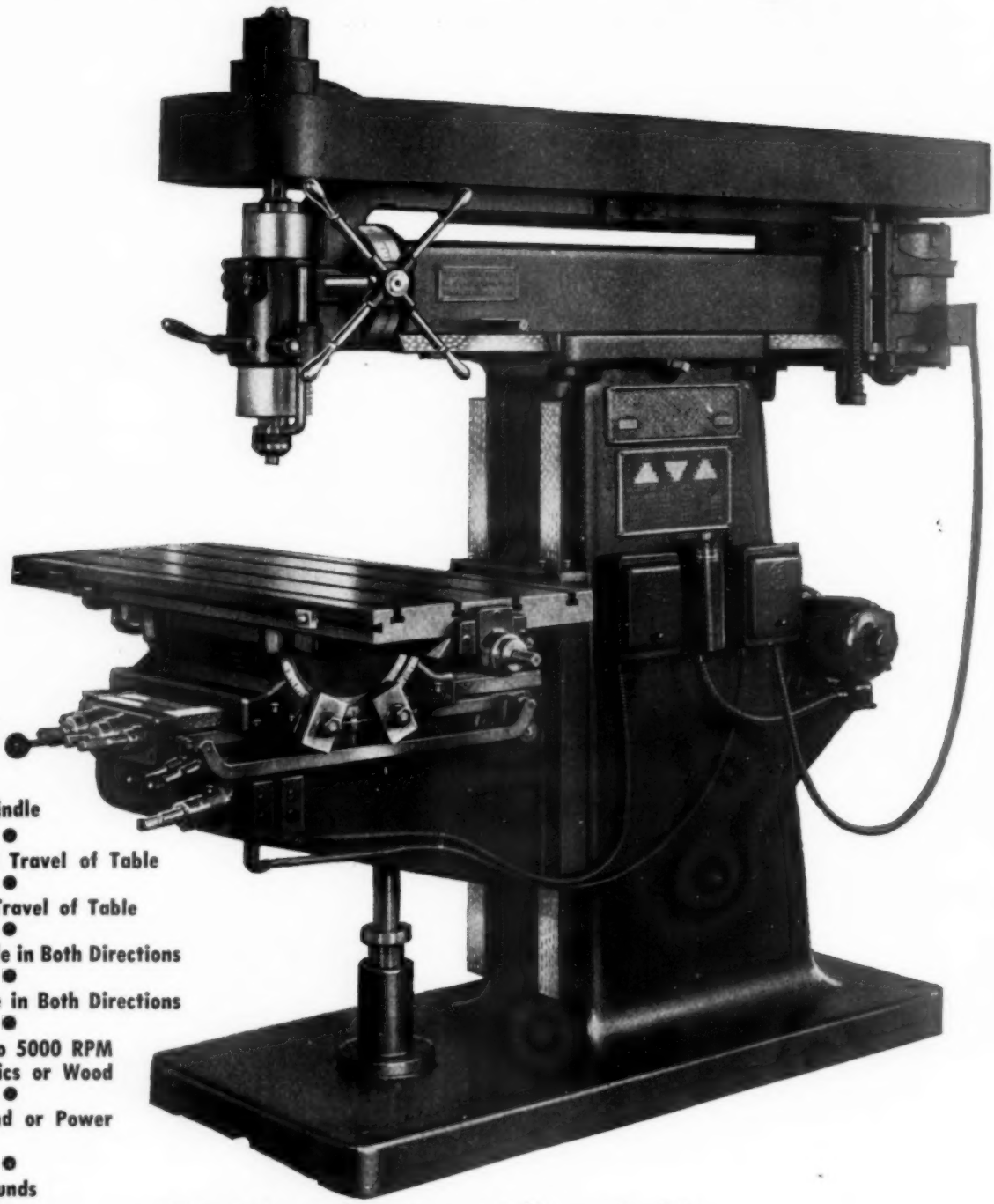
THE BEARDSLEY & PIPER COMPANY

General Offices: 2424 N. Cicero Ave. • Plant: 2541 N. Keeler Ave.

CHICAGO 39, ILLINOIS

• It's a B&P Product! Sandslinger • Speedslinger • Speedmullor • Screenarator • Mulbaro • Sand Conditioning Machine • Champion Speed-Draw

Prompt Delivery



- 32" Throat Clearance
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- 16" Transverse Travel of Table
- 90° Tilting Spindle in Both Directions
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- 12 Speeds 160 to 5000 RPM For Metal, Plastics or Wood
- Available in Hand or Power Feed Table
- Weight 5000 Pounds

540 Universal Pattern Milling Machine

The Freeman Supply Company

Pattern Shop & Foundry Supplies & Equipment

Mahogany and Pine Pattern Lumber

1152 East Broadway **TOLEDO 5, OHIO** **Taylor 4624**

(*Continued from page* 174)

ernize its brass foundry. Conveyor systems and molding and sand handling equipment will be included in the new equipment. Improvements are expected to be completed by Jan. 1, 1948.

• • •

Induction Heating Corp., manufacturer of induction and dielectric heating equipment, has moved to its recently completed quarters at 181 Wythe Ave., Brooklyn 11, N. Y. Company formerly was located at 389 Lafayette St., New York 3. New location provides an area more than twice the size of its former plant.

• • •

J. E. Gilson Co., 369 West Western Ave., Port Washington, Wis., is nearing the final stage of an expansion program which included the installation of a new 72-in. cupola, monorail cupola charging unit, new molding units, and plans for two 800 cu ft air compressors, a sand mixing unit and sand hopper.

• • •

Bellville Foundries Inc., Markey St., Bellville, O., has started construction of a 24 x 65 ft addition which will be used as a shipping room and loading dock. When the new building is completed, the room presently used by the packing and shipping departments will be used for coremaking.

• • •

S. G. Taylor Chain Co., Box 509, Hammond, Ind., has taken over the patents on Caldwell Adjust-A-Leg Chain Sling and renamed the product T M Level-Lift. The new product is a complete lifting assembly made up of an equalizing unit and one continuous steel sling chain with a steel hook on each end.

• • •

Clipper Mfg. Co., 2800 Warwick, Kansas City 8, Mo., has opened a branch office at 208 Noble Court, Cleveland 13. The new factory warehouse and office will carry a complete stock of masonry saws, portable hoists and blades. William E. Davis is district manager and Robert M. Stubbs, office manager.

• • •

Waterman Foundry Co., 515 South "G" St., Exeter, Calif., is being completed at a cost of $250,000 and is expected to be in full operation by Nov. 1. Plant has been operating on a modest schedule for some time, producing castings for the W. A. Waterman Co. Inc., Exeter, manufacturer of irrigation valves.

• • •

Simonds Foundry, subsidiary of Armco Drainage & Metal Co., Berkeley, Calif., suffered fire damage July 31, estimated at $200,000.

• • •

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, has opened a branch office at 528 Eleventh St., Rock Island, Ill. J. C. Wisner and A. B. Rud-

SCREENARATOR
1-The Screenarator conditions sand at lowest cost.
a-thoroughly screens the sand.
b-Frees it from core butts, gaggers and other foreign matter.
c-Cuts and breaks lumps.
d-Aerates the sand.
2-Piles the conditioned sand wherever desired.
3-Ideal for small and large foundries.

SCREENARATOR! Lowest cost portable sand conditioner . . . electrically operated — easily moved from floor to floor — height and angle of screen convenient for fast shoveling. AVAILABLE IN 3 SIZES!

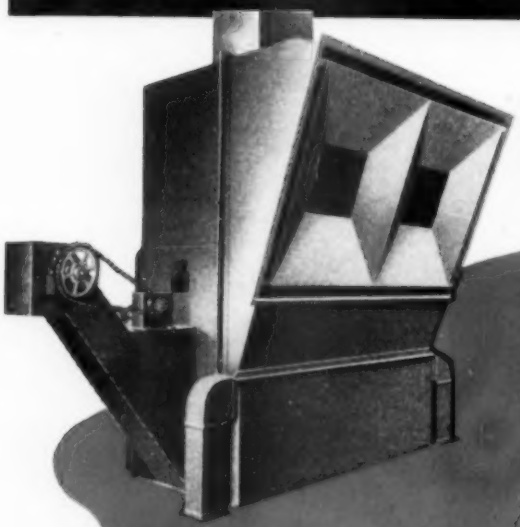
Get complete information on the Screenarator — phone Chicago — Berkshire 3700 or write:

The Beardsley & Piper Co.

General Offices: 2424 N. Cicero Avenue
Plant: 2541 N. Keeler Avenue
CHICAGO 39, ILLINOIS

IT'S A B&P PRODUCT! SANDSLINGER • SPEEDSLINGER • SPEEDMULLOR SCREENARATOR • MULBARO • SAND CONDITIONER • CHAMPION SPEED-DRAW

The UNI-WASH SHAKE-OUT BOOTH



A PRE-ASSEMBLED DUST COLLECTOR

with these 7 Exclusive Features

1	Collects, water washes and dries, then exhausts foundry air—*within one compact unit.*
2	Installed in three easy steps—(1) Locate in place, (2) Connect exhaust duct, (3) Connect electric and water services.
3	Occupies up to 75% less floor space and cubic space.
4	Fan is only moving part in unit . . . water is continuously recirculated by fan suction. No nozzles or pumps to clog.
5	With Automatic Damper attached, these units operate as heavy duty space air washers when the shake-out is not in operation.
6	Five standard units—5,000, 7,500, 10,000, 12,500, 15,000 CFM—used individually or in combination to cope with any dust condition from shake-out, core knock-out, shaker screening, sand transfer, mold conveyor and pouring operations.
7	Lower initial cost than any system of comparable capacity.

SEND FOR CATALOG WHICH CONTAINS COMPLETE DETAILS

Established 1912

NEWCOMB-DETROIT COMPANY

5741 Russell Street • Detroit 11, Michigan

strom will handle sales and service in the new office which is under the jurisdiction of the Chicago district office.

• • •

Moran Flexible Joint Co. Inc., 217 West Main St., Louisville, is improving and enlarging its foundry and production facilities. New molding and cleaning equipment has been installed and additional pouring and storage room provided.

• • •

Walworth Foundries Inc., Walworth, Wis., has purchased a former government-owned hemp plant at Darien, Wis. According to Carl T. Miller company president, the foundry is expected to be moved to the new location by Nov. 1.

• • •

S. G. Taylor Chain Co., Box 509, Hammond, Ind., manufacturer of industrial and tire chains, has appointed Cook & Sholar, Orlando, Fla., as its sales representatives in Florida, Georgia, North Carolina and South Carolina.

• • •

Gasser Bronze & Aluminum Co., 8911 Compton Ave., Los Angeles, has obtained building permit for construction of an $8900 foundry building at 11005 Garfield Ave., South Gate, Calif.

• • •

Texas Technical Section of the Development and Research Division, International Nickel Co. Inc., formerly located in the Bankers Mortgage building, has moved to room 1107, Commerce Bldg., Houston 2, Texas.

• • •

Ohio Cultivator Division of National Farm Machinery Co-operative Inc., 1930 Ohio St., Bellevue, O., plans construction of a new $500,000 foundry scheduled for completion July 1, 1948.

• • •

Great Lakes Mfg. Co., Wyandotte, Mich., has changed its name to Great Lakes Mfg. & Foundry Co. The firm produces light, medium and heavy gray iron castings and alloy irons.

• • •

Mowrey Foundry, 1221 Elm St., Ashland, O., producer of aluminum castings for toy manufacturers, was destroyed by fire Aug. 27. Loss was estimated at $7000.

• • •

R & J Foundry, 9935 West Adler St., West Allis 14, Wis., manufacturers of brass and aluminum castings is being operated by Roy F. Kruck.

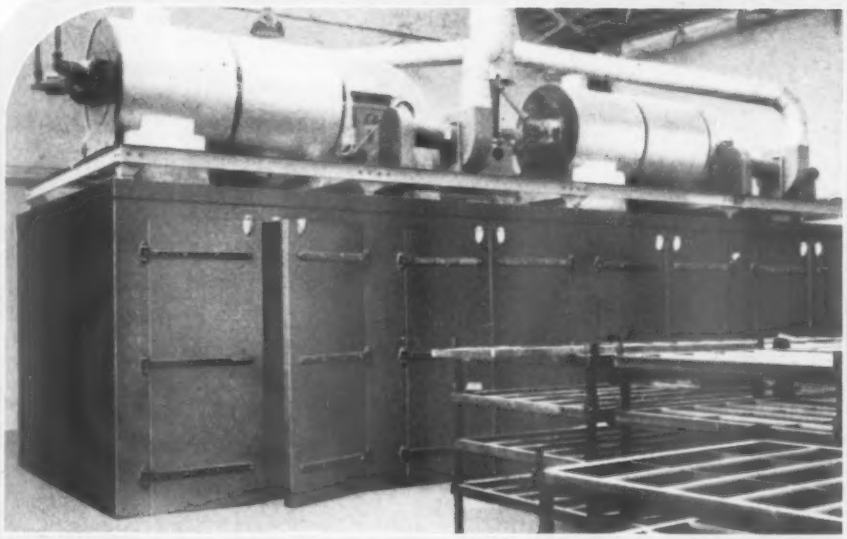
• • •

Firestone Foundries Inc., 5035 Firestone Blvd., South Gate, Calif., has obtained building permit for construction of a $4000 addition to its plant.

• • •

ABC Packaging Machine Corp., Moberly Mo., plans construction of a foundry estimated to cost $500,000.

LANLY *Dual Fuel* OVENS



A four-unit rack-type oven with each compartment individually heated.

THOROUGHLY PROVEN
•
TIMELY
•
EFFICIENT
on either Gas or Oil
•

An improved drawer-type oven. Each drawer is suspended on ball bearing trolleys and can be opened independently without jar or vibration.

A typical Lanly car type mold drying oven. Each compartment is individually heated and controlled.

REGARDLESS of what fuel change-over crisis the morning may bring, no interruption of production will be entailed if you install LANLY Dual Fuel OVENS. The switch from gas to oil, or vice versa can be made in a matter of seconds by turning two valves and throwing a switch.

So efficient and satisfactory are these ovens that most recent Lanly foundry installations have been of this Dual Fuel type.

The Lanly recirculating, convection type heater is not only highly efficient but uncommonly versatile as to installation.

This makes practical its application to ovens of other makes and the satisfactory modification of older equipment.

Isn't it time to do something about the fuel situation to avoid further difficulties and costly interruptions? If you need a new oven there is a Lanly exactly adapted to every requirement. If you have equipment that can possibly be modernized Lanly consultation is available without obligation.

Fill in—clip—and mail the coupon for information.

THE LANLY CO.
OVENS FOR INDUSTRY
HEATED BY GAS, OIL, ELECTRICITY OR STEAM
750 PROSPECT AVENUE CLEVELAND, OHIO

The LANLY Co.
Cleveland, Ohio

☐ Send information regarding Dual Fuel Ovens.

☐ Contact us regarding remodeling our ovens to use gas or oil.

☐ Have representative call when in this vicinity.

Company .....

Address ..... By

The adventures of BILL

By PAT DWYER

Drawings by RICHEY

EVERY once in a while," Bill said the other night, "I get a letter from some lad out on the firing line, the fringe, you might say of the great industrial field that stretches—if I may be pardoned for introducing a poetical figure of speech—from here to there. Some of these compositions are very interesting, while others—well, the less said about them the better. I had one recently—"

"Just a minute," I said. "Just a minute, my good man. If your replies to this miscellaneous correspondence were as vague and windy as the sample package submitted, I should be inclined to say offhand, and without malicious intent, that the writers might just as well have written their letters, just to let off steam, and then thrown them in the first convenient bush by the wayside."

"O yeah? And pray is there any danger of severing the flimsy bonds of friendship if I inquire what's wrong with the foregoing, plain, straight forward and manly statement, delivered, if I do say so, in plain unvarnished language? I rest my case."

"That is just what it needs, a good long rest. You say every once in a while you get a letter. What do you mean, every once in a while? From that statement I cannot determine whether you mean once or twice a year, or that the postman comes knocking at your door when the moon is full, or when a new tenant moves into the White House. Kindly be a little more definite. I am not a mind reader, a crystal ball gazer or a quizz kid on the radio. Furthermore—"

"Furthermore, you haven't got all your marbles, you are sopping wet and you are piping through a hole in your high silk hat. Now that the entangling brush has been cleared away and we are both figuratively sucking cider through a straw from the same bottle, I shall acquaint you with the contents of the latest once in a while letter. The writer is a highly skilled patternmaker. Through a combination of circumstances, and probably as part of the temporal punishment due to sin, he landed in a shop manned by the most incompetent bunch of missfits, boll weevils, wood butchers and partly baked workmen he ever had seen in a fairly long and wide career. As a skilled craftsman, with a proper and legitimate pride in his trade, he felt the same as any artist or skilled performer feels in the presence of ignorance, incompetence, lack of initiative or originality and, most of all, the lack of manual dexterity in the handling of tools. Don't ask me how, where or when. I simply am quoting the Comrade, and since he did not take me into his confidence, the identity of the shop is what you might call anonymous. Shortly before he quit the job, his mounting blood pressure, lowered vitality and symptoms of stomach ulcers coupled with wild dreams at night, prompted him to take his trusty pen in hand. If I might offer a mild criticism, purely from an artistic standpoint, it is on his selection of ordinary black ink. His comments would have been more suitably clothed in a good, solid green ink compounded from vitriol, vinegar, formaldehyde and a generous touch of sheep dip."

"The story sounds promising," I admitted "If we ever get to it."

"We are right there now. Fold your hands and curl up in your little high chair while Uncle Willie reads you the thrilling adventures of an old Comrade temporarily marooned in Robinson Crusoe's work shop.

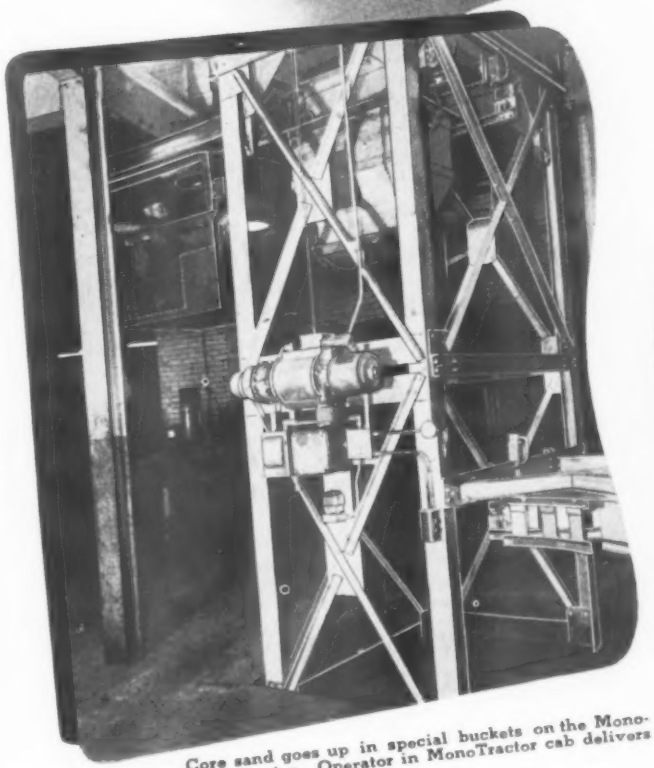
"The letter starts off with Dear Bill. I often wonder why he and other people persist in that unnecessary, usually insincere and occasionally ironic form of greeting. If I met him in the shop or elsewhere he would not greet me as Dear Bill, therefore why should he use the form in a letter?"

"Why do women wear hats? They are neither useful nor ornamental and in many instances they are actually ridiculous. Why waste your time wondering why people act like human beings? People write Dear Bill at the beginning of a letter for the same reason they tack on your's truly or faithfully or sincerely etc., ahead of the signature at the bottom. The implication seems to be that the signature won't be accepted as genuine without some kind of affidavit. Are you going to read the remain-

(*Continued on page* 184)

Reproduction of core oven door art, in color, illustrating foundry wag's conception of pattern shop

Core Sand goes UP and OVER



Core sand goes up in special buckets on the Mono-Rail elevator. Operator in MonoTractor cab delivers the sand to core makers.

MonoRail Track travels throughout the core room over the blowers and benches for delivery of fresh core sand.

Many foundries are eliminating much of their floor congestion by installing American MonoRail "Up and Over"★ Handling Systems.

In this particular foundry, special buckets are loaded with core sand, raised and transported overhead to bins over core blowers and benches. Increased production at lower costs has resulted.

With "Up and Over" type of handling, from cupola to shipping, an overhead track or crane system does a better, quicker job with less maintenance.

Let an American MonoRail engineer show you how an overhead system will increase your production and pay for itself in a very short time.

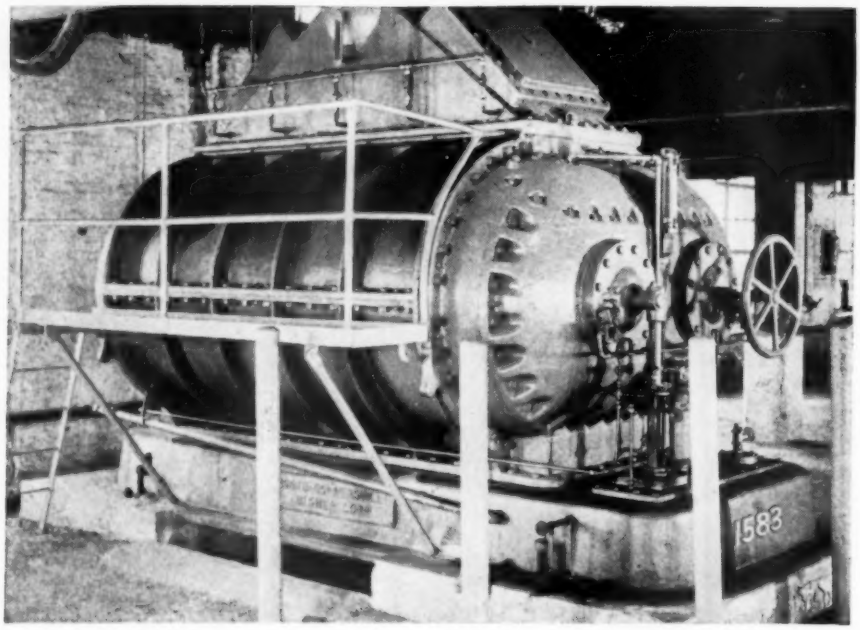
★ "Up and Over" is the title of our 16 MM, sound, twenty minute movie..gladly loaned upon request.

THE AMERICAN MONORAIL COMPANY

13104 ATHENS AVENUE **CLEVELAND 7, OHIO**

MEASURING GAS

calls for *cash register* accuracy



You'll get just that kind of accurate measurement with Roots-Connersville Positive Displacement Meters. That's because:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture or impurities.
2. Accuracy does not depend on uncontrollable factors.
3. Accuracy is not subject to adjustment of meter or recorder by operators.
4. Accuracy is not affected by reasonable overloads.
5. Accuracy is permanent because measuring chambers are surrounded by precision-machined cast-iron surfaces.

Other advantages of R-C Meters include: negligible operating cost, small space requirements and continuous, dependable performance.

For accurately measuring production, consumption or delivery of gas and for interdepartmental accounting, you can count on the cash-register accuracy of Roots-Connersville Meters. For detailed data, ask for Bulletin 40-B-14—free, of course.

ROOTS-CONNERSVILLE BLOWER CORPORATION
701 Madison Ave., Connersville, Indiana

ROOTS-CONNERSVILLE ROTARY CENTRIFUGAL
BLOWER BUILDERS · R-C · SINCE 1854
BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

* * ONE OF THE DRESSER INDUSTRIES * *

(*Continued from page* 182)

der of the letter, or is there any remainder after your friend fell down, exhausted after the opening greeting?"

"Plenty, my boy, plenty. He did not fall down exhausted. From the general tone of the letter I should say that he may have come in under the wire covered with sweat and breathing heavily, but with slight encouragement he easily could have done another canter around the track. Reading between the lines one gathers the general impression that he was riding all the way under a tight rein and never really let himself go."

"Fortunately," I interrupted, "I am not under any handicap of that kind. I can and, what is more to the point, I will let myself go in another five minutes by any reliable stop watch, or if necessary by the old village clock, if you don't swing the barrier to one side and get going. Not," I hastened to explain, "that I am dying to hear the thing, but simply as a symbol of my old boy scout training, one kind act a day."

"Well," Bill said, "I suppose I'll have to take your word for it; but," and here he ran a mildly disparaging eye up and down and cross ways over the figure, "I suppose when the movement first was started they were not so fussy about who was taken in and who was screened out. Every organization has some odd characters. And that goes in a particular way for the inhabitants of the pattern shop described in such loving detail by my old comrade in arms. Listen:

" 'You might think you had seen everything in the way of pattern shops and patternmakers, but certainly you ain't ever seen anything like they have it here in the dump I am in now. One lad laid out a plate on a board. The old burned board had a ¼-in. warp in it. The plate was as crooked as the old bird in the nursery rhyme who walked a crooked mile and found a crooked sixpence and all that jolly old kind of stuff that we swallowed when we were kids. He was told to clean up the plate. File it here and there where you can get a file to work easily. Never mind the teeth that are fairly smooth. If the molder raps the pattern enough, it will come out all right. Then the final pay-off line. He was told to take the crooked plate to a squeezer molder. Ask him to make a mold and see if he would get the pattern out of the sand.

" 'Here's another one you won't believe. Flask pins in mounted job boards are different in size from those in the flasks. The man changes the pins. Takes out the old pins and guesses where the new pins belong. For a test they make a mold and have it cast. Then move the pins. Usually they have to move the

(*Continued on page* 188)

A New and Greater-

PENTON'S FOUNDRY LIST

for 1947-1948

A valuable sales aid in your direct mail and personal contact work with the foundries of the United States and Canada. Gives information on the Gray Iron, Steel, Malleable, Brass, Bronze, Aluminum and Magnesium foundries.

Alphabetically and geographically indexed in sturdy loose leaf form with a durable ring binder and ample space for your own additional notes on each page. All information "keyed" to show at a glance the type of metal melted, whether a machine shop, pattern shop, laboratory etc. is maintained.

The name and address of each foundry is given together with the type and number of melting units, melting capacity and departmental operations.

Penton's Foundry List is recognized as the only list of foundries giving such valuable information arranged for quick, ready reference. This list is fully copyrighted and no authority is given for reproduction or sale of any of the information contained therein.

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BOOK DEPARTMENT

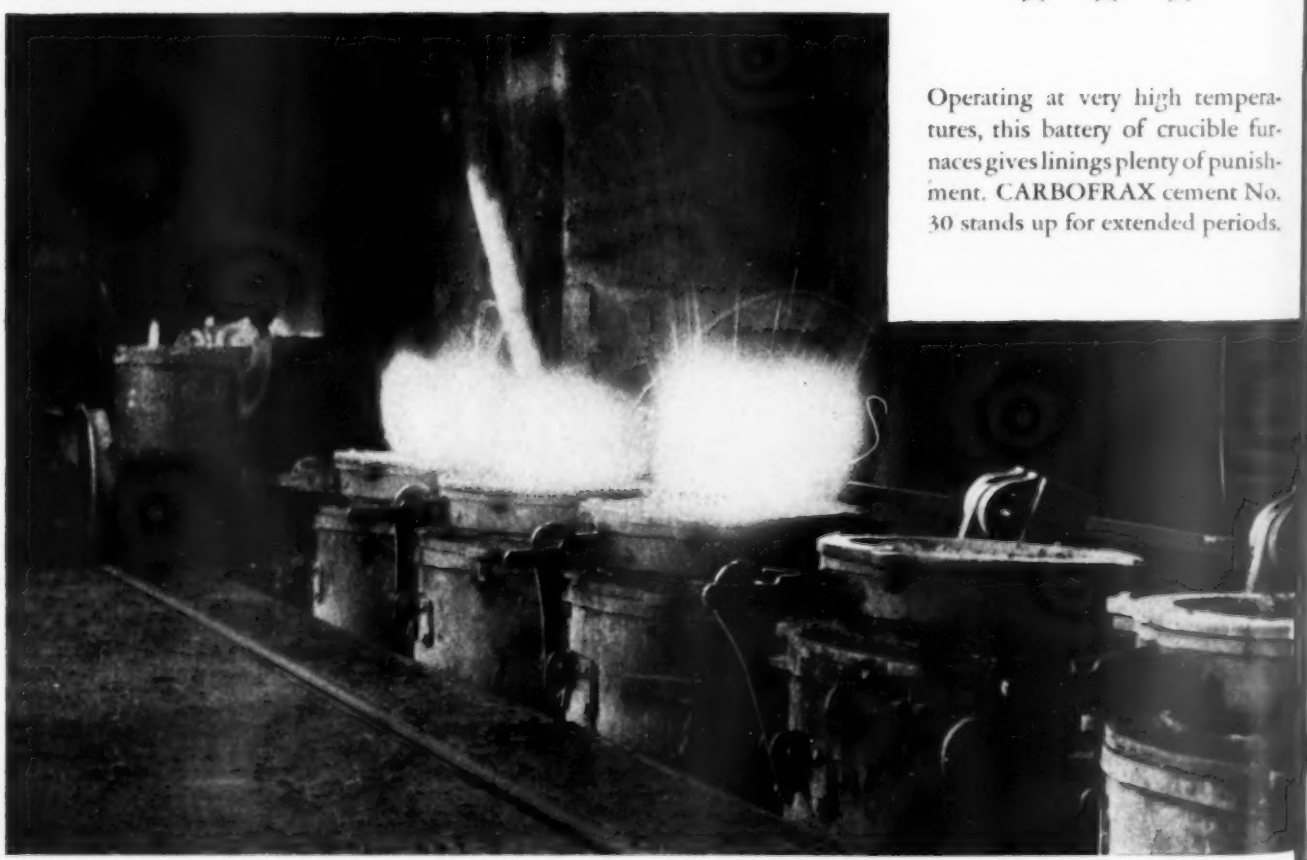
THE PENTON PUBLISHING CO.

1213 W. 3rd Street **Cleveland 13, Ohio**

WHERE ORDINARY L

Hard dense structure and high refractoriness of CARBOFRAX cement lining gives long economical life in open flame melting furnace.

★ ★ ★



Operating at very high temperatures, this battery of crucible furnaces gives linings plenty of punishment. CARBOFRAX cement No. 30 stands up for extended periods.

LININGS BREAK DOWN...

CARBOFRAX silicon carbide cement No. 30 ably withstands the continuous severe conditions encountered in nonferrous furnaces operating at relatively high temperatures. Under identical production conditions, CARBOFRAX cement No. 30 outlasts ordinary linings—requires less patching.

It has high refractoriness... does not soften or slag down at high temperatures. It resists flame impingement... is not subject to rapid wear of flame erosion. Dimensions are retained for longer periods of operation... heat radiation is more uniform. Maintenance and repair are substantially lowered.

Because more metal can be melted for less money, many operators turn to CARBOFRAX cement No. 30 for those tough jobs where the frequent replacement of ordinary linings proves inefficient and uneconomical. Logically, CARBOFRAX cement No. 30 is also used where conditions are not so severe to provide expanded output at less cost.

The experience of these operators suggests a thorough investigation into the use of this tougher and more durable refractory cement in your operations. Our engineers will be glad to cooperate. Write Dept. L-107, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

Gas Fired Crucible Furnace operates on 8 hour 5 day schedule. CARBOFRAX cement No. 30 endures terrific beating... retains dimensions for longer duration.

In this oil fired furnace, fireclay brick required replacement every six weeks. CARBOFRAX cement averages upward of 15 months with little or no maintenance.

SUPER REFRACTORIES

BY CARBORUNDUM

TRADE MARK

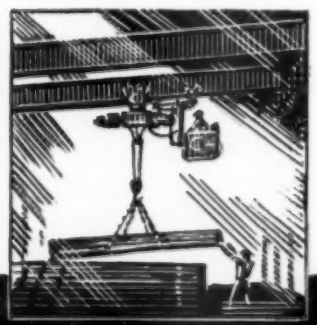
"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

PERHAPS YOUR BUSINESS IS DIFFERENT

With so many ways to manufacture, process and fabricate, businesses may be different insofar as shop practice is concerned. But regardless of whatever competitive advantages you enjoy, your material handling problem is common to all industry. Heavy loads must be picked up, moved and deposited with speed, safety and economy.

Shepard Niles electric hoists have, for many years, been handling loads of from 1/8 to 20 tons smoothly, easily and efficiently in every type of industry.

America's oldest builder of electric hoists and cranes offers you a selection from over 5,000 styles and sizes to enable you to get the hoist best suited for your handling job. Without obligation, trained, experienced Shepard Niles engineers will study your handling operations and recommend a hoist to do the job as you want it done.



Shepard Niles electric cranes are made in types and sizes for every kind of industrial lifting and moving. If you have a heavy handling problem, there's a Shepard Niles to do the job. Our engineers will study your need and recommend the best crane for you. No obligation, of course.

Shepard Niles
CRANE & HOIST CORPORATION

360 SCHUYLER AVE. • MONTOUR FALLS, N. Y.

(*Continued from page* 184)

pins three or four times before the cope lines up with the drag, or near enough to permit grinding the fins so that the casting will pass. Apparently they never heard of a method for doing the job only once to get it correct.

"'Nearly all the cores are made in halves. Vent channels are filed or scratched by hand on the surfaces of the dried halves. The halves then are pasted by hand. I made a two-part corebox for one job. Also made a vent plate and 200 drier shells. One man now makes 200 cores per day. Under former conditions two men spent 8 hours on the same job. Also they had continual trouble with core halves that shifted on the wet paste. The paste also clogged the vent passages. Under a core blower last week a man with a new corebox made 200 beautiful cores per hour. Correct fit, no blowing in mold and practically no scrap.

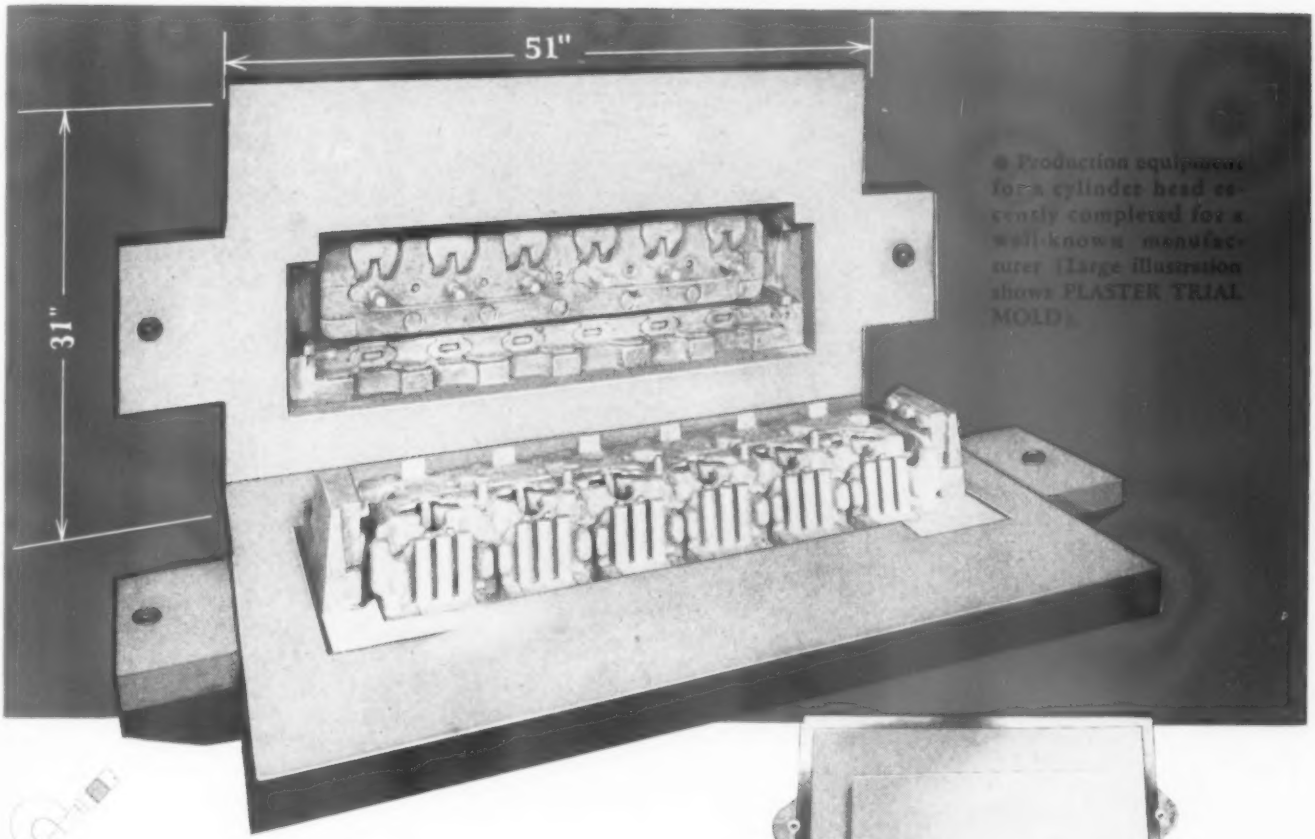
Needs another tap under the hammer

"'An item from Pat Dwyer's book *Gates and Risers for Castings* suggested a solution for a little problem. On a flat nearly rectangular plate 15 x 28 in., and 5/8-in. thick, with rounded corners, the metal entered through two small gates on one of the long sides. Invariably a cold shut area was found on the far side opposite each gate. The mold was made in a flask 24 x 36-in., on a jolt rollover machine. The sprue was at the low end of the mold and the runner was slanted slightly up hill. One gate was at low level. Second gate about 3-in. higher. The upper gate was taken off and when the castings were poured through the single gate, they were all perfect'.

"Now," Bill said as he folded the document and pulled another from a hip pocket, "before we pass on to the next order of business for the Good And Wel-

(*Continued on page* 190)

Another Buffalo PRECISION PATTERN

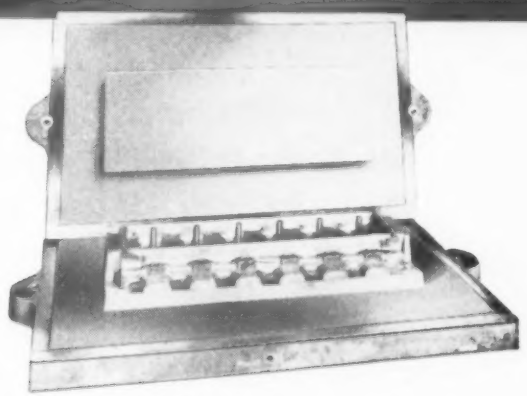


● Production equipment for a cylinder head recently completed for a well-known manufacturer (Large illustration shows PLASTER TRIAL MOLD).

accurate to THOUSANDTHS of an INCH

● Why is it that leading manufacturers of automotive, aircraft and diesel engines put their most intricate pattern making problems in the hands of Buffalo Pattern Works?

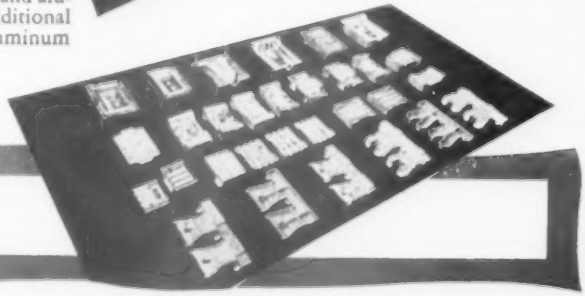
The simple answer is that these manufacturers have learned through the years that Buffalo can be relied upon for "true translations" of their blueprints. This means not only thousandths of an inch accuracy . . . but also metallurgical soundness which combine to make possible fast production of precision castings at lower cost. Consult Buffalo Patterns Works now. Write, wire or phone us, RIverside 3572.



Aluminum cope and drag with steel facing.

Three main core boxes and two rubbing fixtures of aluminum with steel facing.

Miscellaneous aluminum core boxes with steel facing and aluminum core dryers. Additional equipment includes aluminum core setting gauge to fit over flask pins (not shown here).



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The steps you take now—the investment in equipment that you make to cut handling costs will not only pay dividends immediately but can be expected to yield even greater returns in days to come, when handling and other unproductive costs will be under the closest scrutiny.

Roller conveyors are unequalled in low first cost, flexibility and minimum operating expense. They handle a wide range of commodities — molds, castings, parts, units, barrels, bundles, drums, boxes. They are available in light, average, or heavy-duty types for either portable or stationary use—in a wide variety of sizes, styles, and lengths. Roller conveyors are built in their entirety by Standard, including the vital bearings which are manufactured expressly for severe foundry service.

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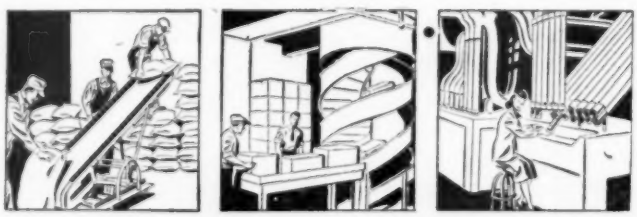

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(*Continued from page* 188)

fare of The Organization, I have another communication on which you might sharpen your teeth. A metallurgist wrote me that he wished to produce in bar form ¾ to ⅞-in. diameter, and 20 to 24 in. in length, a rich alloy of copper, nickel and manganese to be processed later into fine wire by cold drawing. This alloy is very hot short and automatically eliminates forging or hot rolling. For the experiment he expected to use a 20-kw converter with a 17-lb. coreless induction furnace. He stated that the first bar cast vertically in a gray iron mold with a refractory hot top was clean, but was not solid in the center. Apparently the small chill cast bar solidified too fast to be fed from the hot top. In a second attempt he poured the metal into a long, slender copper pig mold 0.625-in. wide, 0.875-in. high and 12 to 15-in. in length. The freezing process was much better, but the amount of necessary subsequent machining rendered the method impractical. Since the chill mold evidently will not serve, he was considering the use of some refractory material. Sand was ruled out on account of the silicon introduced which would have a harmful effect on the alloy. He asked me if I thought a plaster mold would serve.

"On general principles I always hesitate to risk a long distance diagnosis on a peculiar problem which seems to present many unusual features. Also it behooves a man to walk very circumspectly in a situation where he has had no actual experience. Offhand I could not see any difficulty in casting the bar either in a sand or in an iron mold. It is of uniform section and therefore should shrink and contract uniformly. Casting bar or bushing stock in various lengths and diameters, and in sand molds either in vertical or horizontal position, is regarded as common practice. Equally common is the practice of casting rolling mill billets in cast iron molds.

"Plaster molds would serve the purpose admirably except for one item. I do not think the material is sufficiently refractory. From the description, the metal is closely related to monel, a metal that is melted and poured practically at the same temperature as steel. With either the sand or plaster mold, the pattern is pulled through one end of the mold, to leave a mold cavity clean and smooth without any joint line. I wondered if he had used a two-part mold for his experiment. A possibility exists that a trifling fin here and there along the joint interfered with the normal contraction of the casting and thus was responsible for the lack of density and homogenity in the center. The refractory feeding head on top of the mold,

(*Concluded on page* 192)

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Edco Dowmetal

BOTTOM BOARDS

--so DURABLE they can be considered *Permanent Equipment*

The revolutionary new EDCO DOWMETAL Bottom Boards have so many advantages over anything previously known that they are finding immediate acceptance in foundries throughout the country.

These boards are made of *magnesium*. They are even lighter in weight than wood, and possess incredible resistance to heat. They will not warp or break, and normal "run-outs" and "spills" of molten metal will not harm them. There are no nails to come loose, nothing to break or split.

EDCO DOWMETAL Bottom Boards may be considered permanent foundry equipment because of their durability under most foundry conditions.

You will find that EDCO DOWMETAL Bottom Boards will save you money because they give better mechanical results and last so much longer than even better-than-average wood boards.

Write for complete details and prices covering the wide range of standard sizes.

When used as a combination squeezer and bottom board, EDCO DOWMETAL magnesium boards give firm, equal distribution of pressure, eliminating mold "shifts", "breaks" or "cracks". They maintain high quality of castings and reduce rejects because special *vented design* permits escape of gasses and helps retain sand permeability.

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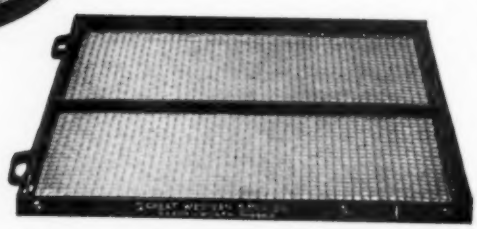

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3	16	1.30	1.80	2.25	4.20
3-1/2	18	1.30	1.80	2.25	4.20
4	18	1.30	1.80	2.25	4.20
5	20	$1.30	$1.80	$2.25	$4.20
6	20	1.30	1.80	2.25	4.20
8	20	1.30	1.80	2.25	5.00

Discounts 1 to 5—Net
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Can be mixed meshes but for same type machine.

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Type V $3.60 set
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DELIVERY NOW IN 2 DAYS ON ALL COMBS FOUNDRY RIDDLES—SEE YOUR LOCAL FOUNDRY SUPPLY HOUSE

Great Western Manufacturing Company
LEAVENWORTH, KANSAS

(*Concluded from page* 190)

by interfering with contraction, could produce the same result. Probably at one time or another every foundryman has seen the neck of a roll or other projecting part torn from a casting in this manner.

"In the present instance I suggested the use of a one-piece cast iron mold 25 in. in length, with a machined, smooth hole 0.75-in. through the center. Metal from a small lip ladle may be poured carefully into the top, until the mold is filled to within an inch of the top. For experimental purpose it might be interesting to mount the mold on a pattern or foundation plate to which a vibrator is attached. The vibrator is operated until the casting has solidified. I also suggested it might be worth while to get in touch with the Naval Research Laboratory, Anacostia, Washington. Members of the staff have conducted extensive exploration in the field of metal shrinkage and contraction. Attention was directed to 'Applies Atmospheric Pressure To Secure Sound Castings' in THE FOUNDRY October, 1942, p.74; 'Use of Insulating Pads and Riser Sleeves,' October, 1945, p.88, Part 2, November, 1945, p.106; 'Casting in Plaster Molds,' March, 1944, p.98.'"

Opens New Research Laboratory

Establishment of the Research Laboratory for Mechanical Metallurgy at Case Institute of Technology, Cleveland, has been announced. Dr. George Sachs, professor of physical metallurgy has been appointed director. The new laboratory, in the Rockefeller Metallurgical Engineering Building on the Case campus, is one of the most complete of its type in engineering colleges of the country. Problems on which the research group at the laboratory are working at present include flow and fracture of metals, analysis of various metal forming and joining processes, stress and strain analysis, heat treatment of steels and casting.

Announces Course in Quality Control

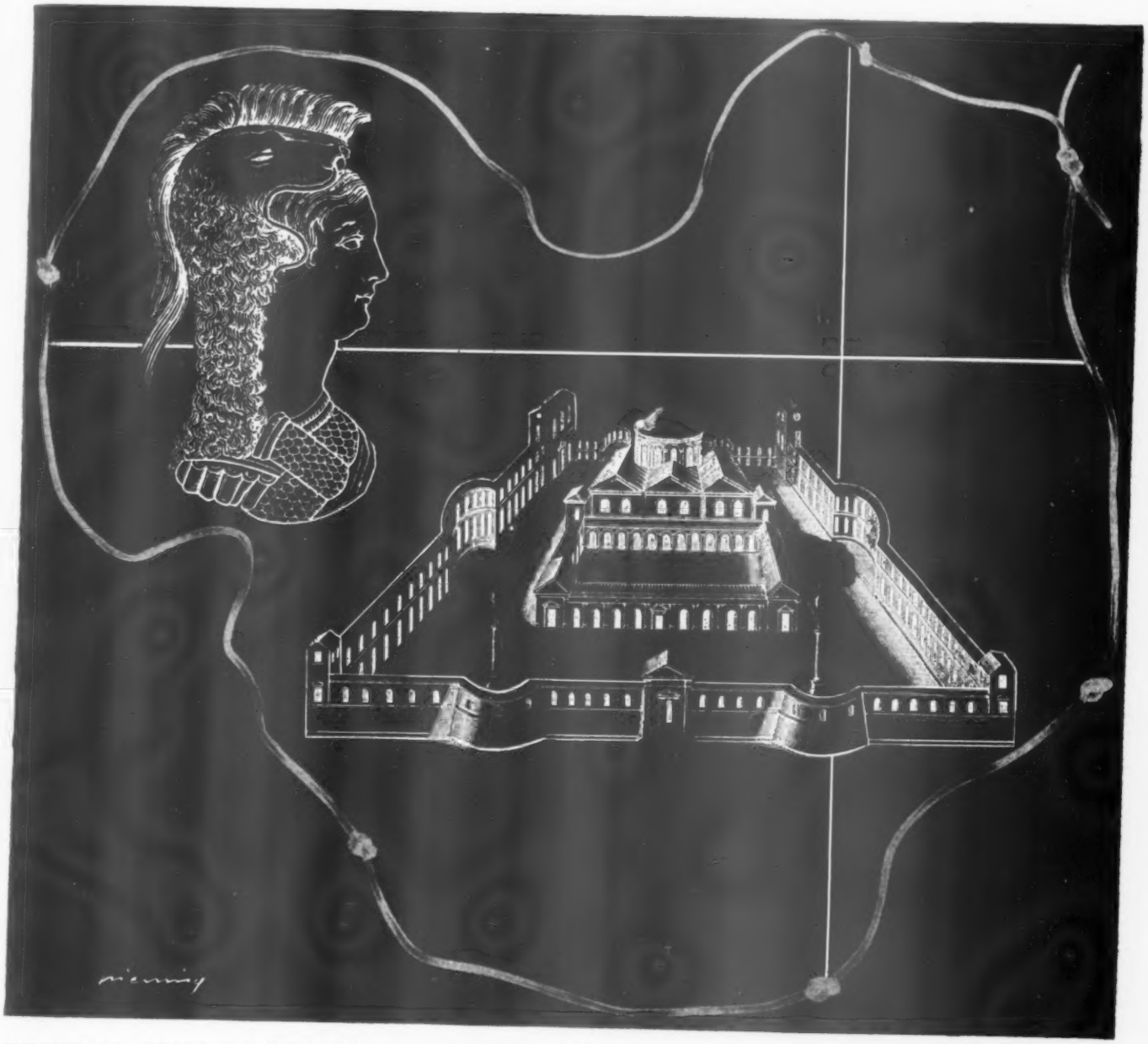
An intensive 10-day course in "Quality Control by Statistical Methods," starting Oct. 28, has been announced by the University of Iowa. These statistical methods were developed by some of the nation's leading industries with co-operation of the Army and Navy and other governmental agencies. Tuition for the course including books and supplies is $100. Applications and additional details regarding the course may be secured from Prof. Lloyd A. Knowler, State University of Iowa, Iowa City, Iowa.

A LITTLE DOES A LOT

According to legend, when the city of Carthage was founded, Queen Dido was told that she could have only as much land as could be encompassed by an ox hide. But the queen made the most of her material by cutting it into a single, continuous leathern string, with which she circled considerable acreage.

Making materials serve to the fullest is just as important to users of steel today as it was to Dido. Except that today no tricks are necessary.

It can be done in many instances by specifying molybdenum cast steels. Their hardenability and freedom from temper brittleness help to simplify design problems and insure good performance. It will pay you to investigate the practical advantages of these fields.



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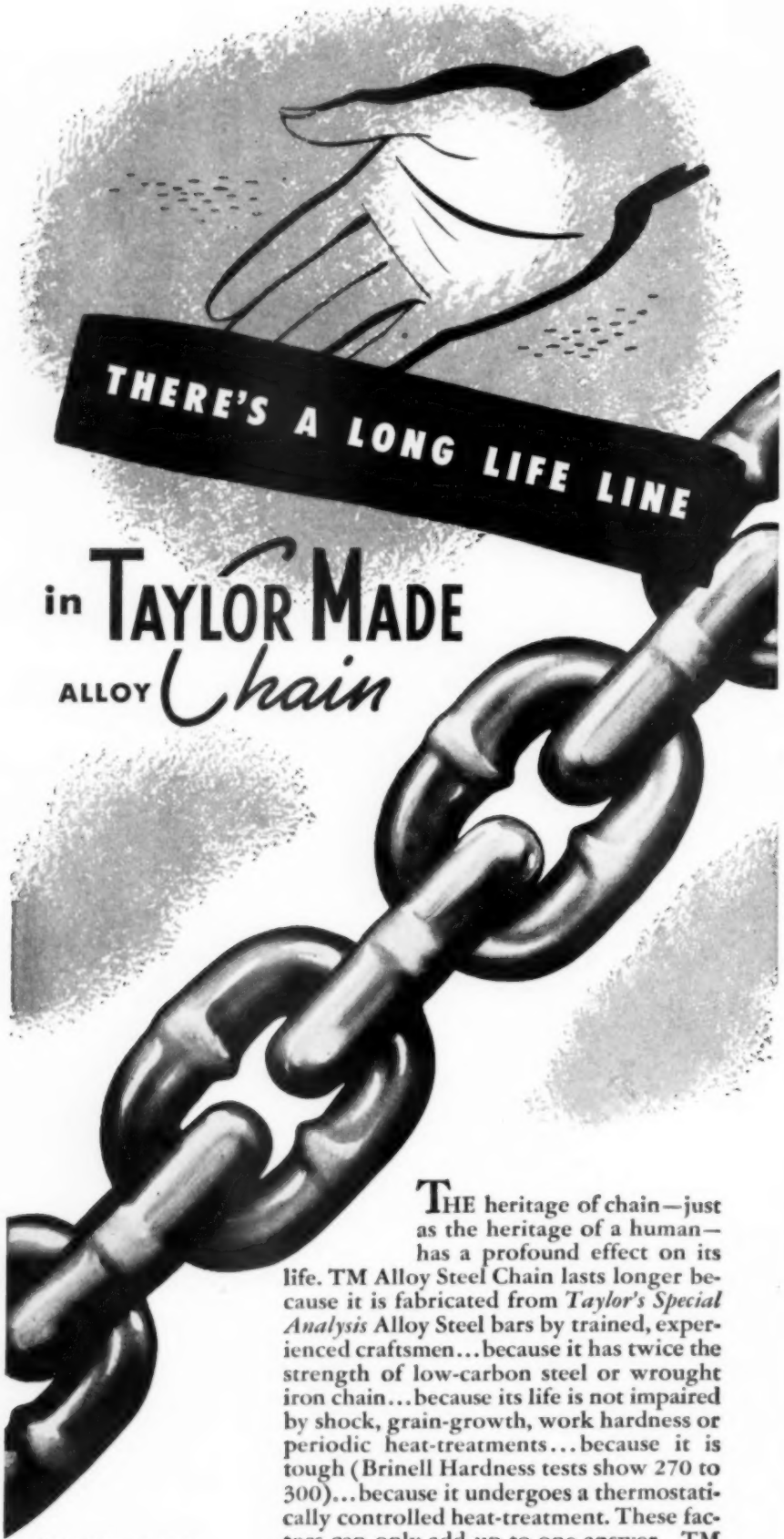

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HOW TO PREVENT SNAGGING WHEEL BREAKAGE

(*Continued from page* 84)

much tightening."

Blotters, or gaskets of any kind, will not correct uneven pressure between wheel and flanges caused by sprung or worn flanges. "Blotters", as all types of gaskets are called, are used because all wheels are more or less rough and irregular on the sides, which makes complete flat contact between the wheel and a bare flange impossible. Blotters tend to even up the contact and to prevent slipping with less pressure. They also reduce the wear on the flange which would result if there were metal to wheel contact.

It is important that blotters be a little larger than the flanges, properly centered so that there will be complete contact with the flanges, and free from wrinkles and roughened spots or adhering foreign material—any of which would increase the pressure at those spots.

Blotter May Break Wheel

If a wheel begins to slip for any reason, the blotter may become the immediate cause of wheel breakage. It is not uncommon to find that wheel slippage has torn the blotter and that the pieces have gradually accumulated at one spot. When it is finally noticed that there is slipping between wheel and flanges, the wheel is usually tightened, putting enough excess pressure on the wheel at the "high" spot to break the wheel.

The Safety Code provides that all types of flanges shall be undercut to provide clearance between the flange and the wheel at the edge of the wheel hole, for pressure at that point is a common cause of breakage. The code specifies that the recesses for flanges shown in Figs. 1 and 8 shall be at least 1/16-in. for the distance shown in the tables, and that straight flanges shown in Figs. 2 and 3 shall be recessed so that there will be no bearing on the sides of the wheel within ⅛-in. of the hole. The Safety Committee of the Grinding Wheel Manufacturers Association recommends that for mountings of the type shown in Fig. 5 the flange which is part of the pilot should be undercut about ⅛-in. and never less than 1/16-in.

Breakage of wheels due to lack of such clearance is very common. Fig. 7 shows an extreme yet not unusual condition. Not only is there no clearance—the condition is aggravated by there actually being a fillet where the clearance should be. As a result there is

(*Continued on page* 198)

ALUMINUM *Casting* ALLOY

CHECK CHART

AID IN OBTAINING THE REQUIRED PROPERTIES

In any casting, certain mechanical and physical properties may be the critical ones desired. This check chart lists the various principal properties of a number of different aluminum casting alloys. By its use you can indicate the *critical* properties which you require for a specific application.

- ☐ Uniformly Good Castability
- ☐ Good Machinability
- ☐ Dimensional Stability
- ☐ Great Strength without Heat Treatment
- ☐ Take and Hold a High Polish
- ☐ High Hardness
- ☐ Superior Mechanical Properties at a Favorable Cost
- ☐ Good Pressure Tightness
- ☐ Freedom from Shrinkage Porosity
- ☐ Reduced Thermal Expansion
- ☐ High Strength at Elevated Temperatures
- ☐ * ....
- ☐ * ....

*The blank spaces are for your convenience in noting properties desired which are not listed in this chart.

After you have checked the critical properties desired for a particular casting, mail the chart to us. We shall be glad to send you information on the National Brand aluminum alloy which provides most closely the properties indicated.

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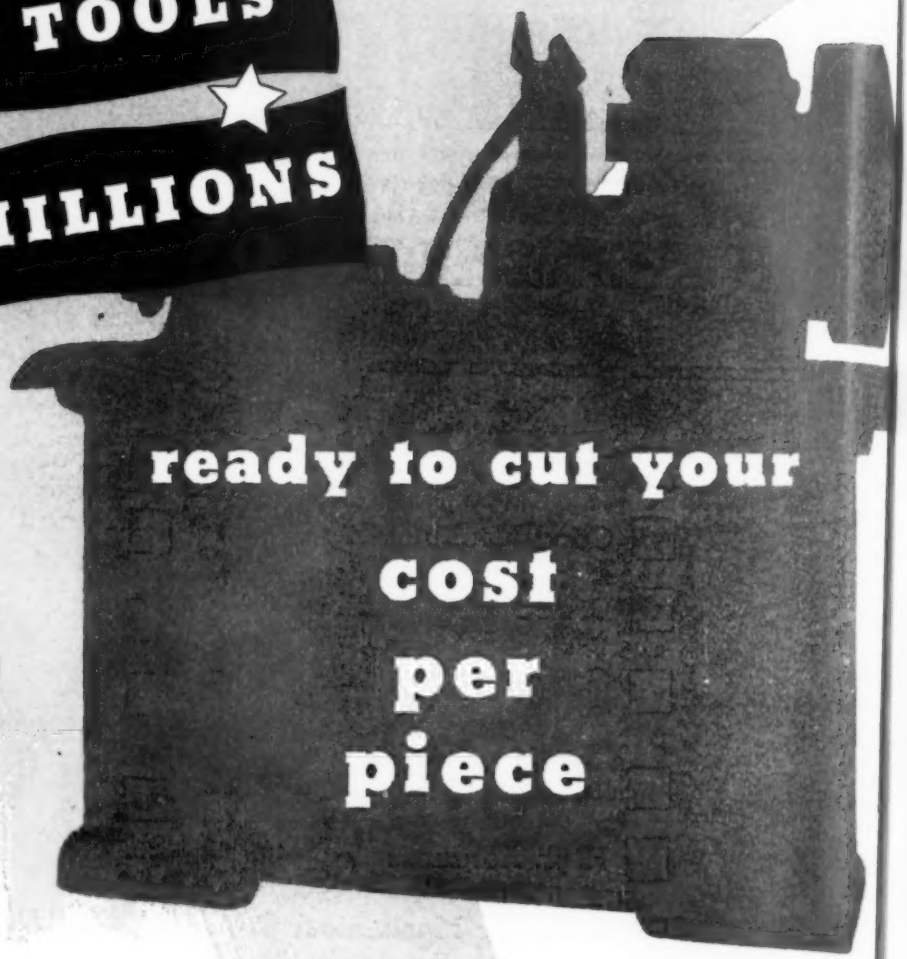

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GRINDER, Plain External Cylindrical
Norton Model C Plain. 6" Swing, 18" cc.
Sales Price: $986.00.
Location: Detroit, New York, Kansas City Regions.

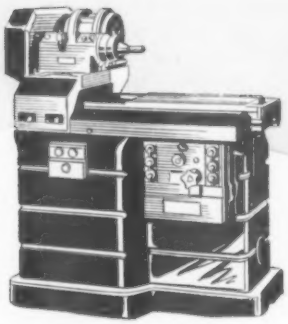
War Assets Administration has the machine tools you need to cut costs—to modernize—to set up a new shop. Look at the big bargains shown. They are typical of scores of types, hundreds of models that must be sold at rock bottom prices—at least 25% BELOW USED MARKET.

Listings of available machine tools are on file in all WAA Customer Service Centers. They include the major makes and types manufactured by the American Tool Industry. Plenty of models for both large and small shops. Initial payment as low as 15% when you use WAA's Deferred Payment Plan.

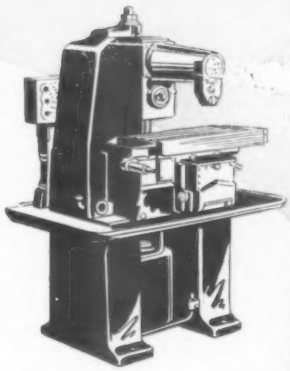
Get in touch with your nearest WAA Customer Service Center for details of current offerings. Bargains like this won't last—so act today!

ALL TOOLS SUBJECT TO PRIOR SALE

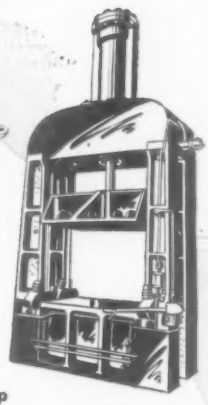
THESE ARE TYPICAL OF CURRENT OFFERINGS



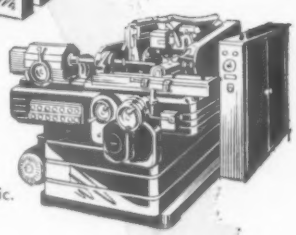
BORING MACHINE, Horizontal, Precision, Bridge Type
Ex-cell-o Model 2112-A, Single End, 6" Diameter Bore, 12" Table Travel.
Sales Price: $720.00.
Location: New York, Detroit Regions.



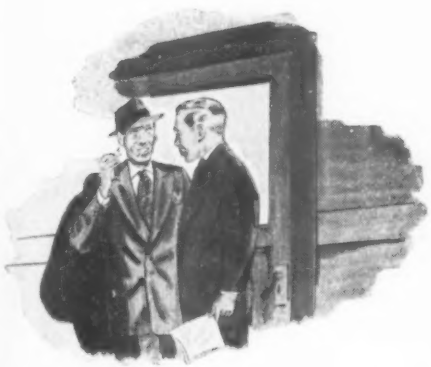
MILLING MACHINE, Bed Type, Horizontal Spindle
Cincinnati Model 08, Plain Automatic (Not Rise and Fall), 8" Table Travel, 6½" Width.
Sale Price: $459.00.
Location: Detroit Region.



HAMMER, Air Drop
Chambersburg, Cecostamp Model ELPLANK. Bed Area 66" x 48"
Sales Price: $3684.00.
Location: Los Angeles, Grand Prairie, Kansas City Regions.



GRINDER, External Thread
Ex-cell-o Model 33, Plain, Automatic. 6" Diameter, 18" cc.
Sales Price: $1929.00.
Location: Detroit, New York, Kansas City Regions.



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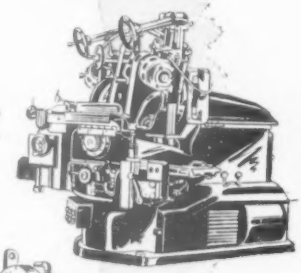
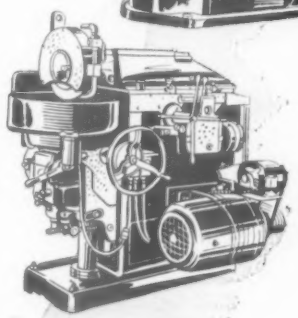
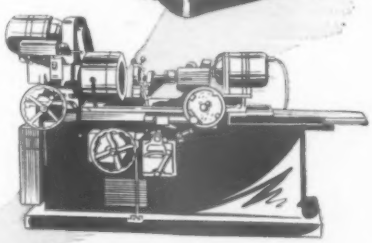


GRINDER, Gear Tooth
Pratt & Whitney Model 1679, Two Wheel Helical Gear, 10 11/16" Dia. 1¼" Face.
Sales Price: $3300.00.
Location: Kansas City Region.



GRINDER, Rotary Surface
Arter Models A1-8", A3-12", A3-16" Horizontal Wheel Spindles. 8½", 12" and 17" Table Diameters.
Sales Prices: $1022.00, $1380.00, $1494.00.
Location: Cincinnati Region.



GRINDER, Internal Cylindrical
Heald Model 72A3 Plain Hydraulic Feed. 11½" Swing, 12" Stroke.
Sales Price: $1327.00.
Location: Detroit, New York, Cincinnati Region.

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Hand or automatic blast gate control—any capacity required. Ask for bulletin No. 112.

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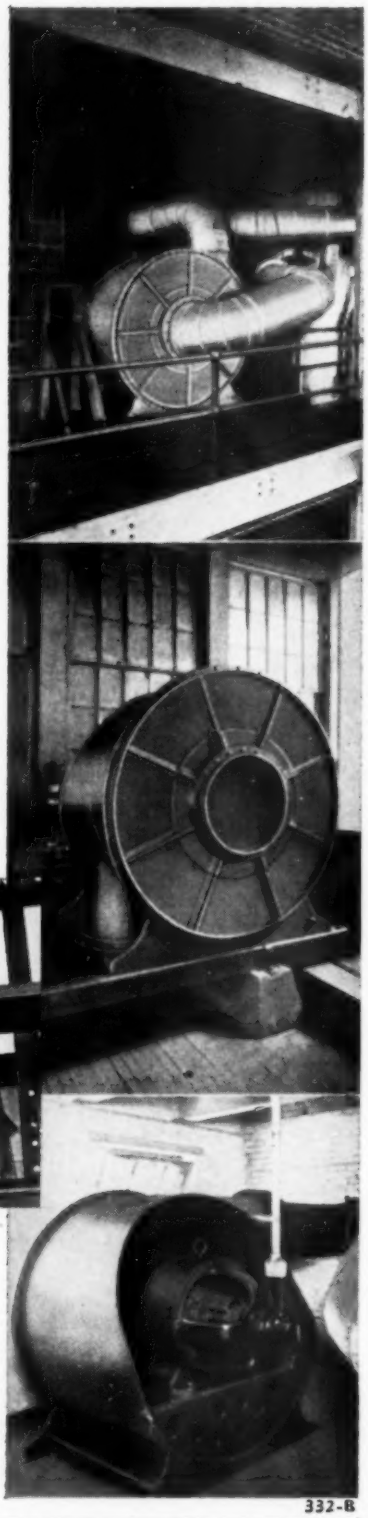

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Data Book	No. 107
Gas Boosters	No. 109
Four Bearing	No. 110
Blast Gates	No. 122
Technical Bulletin	No. 126

332-B

SPENCER HARTFORD

THE SPENCER TURBINE CO.

HARTFORD 6, CONN.

(*Continued from page* 194)

practically no bearing of the flanges against the sides of the wheel, and the fillet is forced into the hole with the results that could be expected if an over-size, tapered pilot were to be forced in.

New flanges are practically always undercut properly, but as the bearing surfaces of the flanges wear away the clearance will gradually disappear. Unless the machinist who trues up flanges is emphatically informed as to the absolute need for clearance, he may not put it in when refacing the flange.

The same effect as that produced by no clearance sometimes results from an accumulation of dirt, grit or grease which fills up the recess. It pays to clean a flange of all foreign material before putting it on a wheel.

All Known as Pilots

Since the pilot, wheel sleeve, or adapter used in adapter mountings, Fig. 5, is subject to the same mounting faults as machine arbors or spindles on which small hole wheels are mounted, we shall for brevity refer to them all as "pilots," referring as before to Fig. 5.

Serious stresses may be set up in a wheel if the pilot is either oversize or undersize. To prevent its being undersize, the Safety Code specifies that allowance for mounting fit shall be provided by making the wheel hole larger, not by making the pilot smaller. The tolerance for pilots is set at +0, −.002 in.

If a wheel is forced on an oversize pilot, initial stresses are set up which increase in magnitude as the spindle warms up and expands to the point where the wheel may break even at speeds for which it is designed.

To prevent the possibility of a too-tight fit the hole is made enough larger than nominal to enable the wheel to slide onto a new pilot without binding. The amount of hole oversize ranges from .006 to .010-in., depending on the size of the wheel.

Repeated fitting of wheels to a pilot gradually wears the metal to the point where the pilot is appreciably undersize. This, added to the necessary and allowed oversize of the wheel hole will in time allow considerable play between wheel and pilot—so much that the wheel will run considerably out of true. If there is much play it will be practically impossible to center the wheel and pilot. This will cause serious out-of-balance and consequent pounding of the wheel against the work, either of which is a possible cause of wheel breakage.

To prevent this, all pilots should be inspected frequently to make certain that

(*Concluded on page* 200)

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	MINIMUM	TYPICAL
Tensile strength, p.s.i.	50,000	55,000-60,000
Yield strength, p.s.i.	28,000	32,000-35,000
Elongation, 2"	16%	20% - 30%

ACME *Almag 55*

For the first time in aluminum history, Acme makes available aluminum castings with tensile strength in the 50,000-60,000 p.s.i. range.

This remarkable new alloy is Acme *ALMAG 55*, named for its aluminum and magnesium content. In addition to its great strength, it has unusually high elongation, impact resistance, and corrosion resistance. It machines well and has a beautiful, silver-like appearance that can be given a lasting polish or anodized, dyed or painted.

Due to its high guaranteed properties, Acme *ALMAG 55* can be considered for a wide range of applications including many in which cast and malleable iron and other heavy metals are now specified. Furthermore, Acme controlled casting and heat-treat techniques, lighter weight, and reduction in machining time combine to produce a favorable cost analysis.

	MINIMUM	TYPICAL
Tensile strength, p.s.i.	33,000	38,000-41,000
Yield strength, p.s.i.	15,000	18,000-21,000
Elongation, 2"	7%	10% - 15%

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Now you can obtain high strength aluminum castings *as cast*. Acme *ALMAG 35* offers maximum physical properties greater than aluminum alloys containing copper, zinc, or silicon even after these other alloys have been heat treated. This new Acme alloy is characterized by high corrosion resistance, 33,000 to 41,000 p.s.i. tensile strength (as cast), excellent ductility, and good machinability.

Generally speaking, Acme *ALMAG 35* offers the same advantages as the best previously available aluminum casting alloys . . . with the elimination of heat treatment. This is of unusual importance where heat-treat facilities are not available or where cost is an important factor. Furthermore, Acme *ALMAG 35* can be cast by sand, die, plaster, or permanent mold processes.

Available in either castings or ingots.

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TRIPLE A

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NIAGARA FALLS
Smelting & Refining Division
Continental-United Industries Co., Inc.
BUFFALO 17, NEW YORK

(*Concluded from page* 198)

they have not worn undersize. If large enough micrometers for the measurements are not available, an assortment of ring gages should be supplied to the inspector. Current best practice is to make the "go" gages about .003-in. over standard, and the "no go" gages about .008-in. under standard. When the pilot has worn to the point where the "no go" gage slides on it, the pilot should be repaired or discarded. Some pilots can be turned down enough to permit shrinking on sleeve, which is then ground to size. Or, the pilot may be built up with spray metal or with welding rod and ground down to size.

Observe Three Precautions

Three other precautions against wheel breakage, while not so important as those which have been discussed in detail, are still worth observing. They are indicated in Fig. 5, and are:

1. The length of the pilot, or the combined length if both flanges have pilots, should not be more than about two-thirds the thickness of the wheel. This is to make sure that the length of the pilot will not by any chance exceed the thickness of the wheel by even the smallest amount, for that would of course prevent the flanges from having any bearing whatever on the wheel.

2. The end of the pilot should be rounded or chamfered to prevent its binding in the wheel.

3. The loose flange must not rest upon the threaded portion of the spindle. If it should, the hole of the flange would become worn, permitting the flange to run off-center and there would be some tendency for the threads to have a tightening effect on the flange.

Several times in these articles we have stressed the desirability of having a man or group of men in the shop whose duty it should be to inspect and check grinding wheels, grinding machines and their attachments, their mountings and the speeds and conditions under which they operate. It is not safe nor economical to leave those important functions to the machine operator, for he is unlikely to be fully informed on the intricacies of all phases of snagging technique and safety precautions. Worst of all, the ordinary operator is more than likely to be careless.

Assigning the responsibility for preventing wheel breakage to competent people will certainly reduce, and may eliminate, the often high cost of wheel breakage as an element of snagging costs, as well as the cost of damaged machines, and the injury to men.

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GLOSSARY OF TERMS EMPLOYED IN HEAT TREATING OPERATIONS

(Concluded from September)

NORMALIZING—A process in which a ferrous alloy is heated to a suitable temperature above the transformation range and is subsequently cooled in still air at room temperature.

OVERHEATED—A term applied when, after exposure to an excessively high temperature, a metal develops an undesirably coarse grain structure but is not permanently damaged. Unlike a burnt structure, the structure produced by overheating can be corrected by suitable heat treatment, by mechanical work, or by a combination of the two.

PATENTING—In wire making, a heat treatment applied to medium-carbon or high-carbon steel before the drawing of wire or between drafts. This process consists in heating to a temperature above the transformation range, and then cooling, to a temperature below that range, in air or in a bath of molten lead or salt maintained at a temperature appropriate to the carbon content of the steel and to the properties required of the finished product.

POSTHEATING—A process used immediately after welding, whereby heat is applied to the weld zone either for tempering or for providing a controlled rate of cooling, in order to avoid a hard or brittle structure.

PRECIPITATION HARDENING—A process of hardening an alloy in which a constituent precipitates from a supersaturated solid solution. See also age hardening and aging.

PREHEATING—(1) A general term used to describe heating applied as a preliminary to some further thermal or mechanical treatment. (2) A term applied specifically to tool steel to describe a process in which the steel is heated slowly and uniformly to a temperature below the hardening temperature and is then transferred to a furnace in which the temperature is substantially above the preheating temperature.

PROCESS ANNEALING—In the sheet and wire industries, a process by which a ferrous alloy is heated to a temperature close to, but below, the lower limit of the transformation range and is subsequently cooled. This process is applied in order to soften the alloy for further cold working.

QUENCH HARDENING—A process of hardening a ferrous alloy of suitable composition by heating within or above the transformation range and cooling at a rate sufficient to increase the hardness substantially. The process usually involves the formation of martensite.

QUENCHING—A process of rapid cooling from an elevated temperature by contact with liquids, gases or solids.

Prepared by the *Joint Committee on Definition of Terms Relating to Heat Treatment* sponsored by the American Society for Testing Materials, American Society for Metals, Society of Automotive Engineers, and the American Foundrymen's Association. As revised in Dec. 1946.

SANDBERG SORBITIC TREATMENT—A treatment in which objects made of carbon steel are moderately hardened, either wholly or partly. The objects to be hardened are cooled through the transformation range at a moderately rapid rate by the application of jets of air, steam, or atomized water; then the residual heat in the metal is allowed to effect a tempering operation.

SECONDARY HARDENING—Tempering certain alloy steels at certain temperatures so that a hardness is obtained greater than that resulting from the tempering of the same steel at some lower temperature for the same time.

SELECTIVE HEATING—A process by which only certain portions of an object are heated, so that they may have the desired properties after cooling.

SELECTIVE QUENCHING—A process by which only certain portions of an object are quenched.

SOAKING—Prolonged heating of a metal at a selected temperature.

SOLUTION HEAT TREATMENT—A process in which an alloy is heated to a suitable temperature, is held at this temperature long enough to allow a certain constituent to enter into solid solution, and is then cooled rapidly to hold the constituent in solution. The metal is left in a supersaturated, unstable state and may subsequently exhibit age hardening.

SPHEROIDIZING—Any process of heating and cooling that produces a rounded or globular form or carbide in steel. Spheroidizing methods frequently used are:

1 Prolonged holding at a temperature just below Ae_1.
2 Heating and cooling alternately between temperatures that are just above and just below Ae_1.
3 Heating to a temperature above Ae_1 or Ae_3 and then cooling very slowly in the furnace, or holding at a temperature just below Ae_1.
4 Cooling at a suitable rate from the minimum temperature at which all carbide is dissolved, to prevent the re-formation of a carbide network, and then reheating in accordance with method 1 or 2 above (applicable to hypereutectoid steel containing a carbide network).

STABILIZING ANNEAL—A treatment applied to austenitic stainless steels that contain titanium or columbium. This treatment consists of heating to a temperature below that of a full anneal in order to precipitate the maximum amount of carbon as titanium carbide or columbium carbide. This eliminates precipitation at lower temperatures, which might reduce the resistance of the steel to corrosion.

STRAIN AGING—Aging induced by cold working. See aging.

STRESS RELIEVING—A process of reducing residual stresses in a metal object by heating the object to a suitable temperature and holding for a sufficient time. This treatment may be applied to relieve stresses induced by casting, quenching, normalizing, machining, cold working, or welding.

GLOSSARY OF TERMS EMPLOYED IN HEAT TREATING OPERATIONS

TEMPER BRITTLENESS—Brittleness that results when certain steels are held within, or are cooled slowly through, a certain range of temperature below the transformation range. The brittleness is revealed by notched-bar impact tests at room temperature or lower temperatures.

TEMPER CARBON—The free or graphitic carbon that comes out of solution, usually in the form of rounded or equiaxed nodules in the structure, during the graphitizing or malleablizing of white cast iron.

TEMPERING—A process of reheating quench-hardened or normalized steel to a temperature below the transformation range, and then cooling at any rate desired.

TRANSFORMATION RANGE or TRANSFORMATION TEMPERATURE RANGE—The temperature interval within which austenite forms while ferrous alloys are being heated. Also the temperature interval within which austenite disappears while ferrous alloys are being cooled. The two ranges are distinct, sometimes overlapping but never coinciding. The limiting temperatures of the ranges depend on the composition of the alloy and on the rate of change of temperature, particularly during cooling. See transformation temperature.

TRANSFORMATION TEMPERATURE—The temperature at which a change in phase occurs. The term is somtimes used to denote the limiting temperature of a transformation range. The following symbols are used for iron and steel:

Ac_1. The temperature at which austenite begins to form during heating.

Ac_3. The temperature at which transformation of ferrite to austenite is completed during heating.

Ac_{cm}. In hypereutectoid steel, the temperature at which the solution of cementite in austenite is completed during heating.

Ar_3. The temperature at which austenite begins to transform to ferrite during cooling.

Ar_1. The temperature at which transformation of austenite to ferrite or to ferrite plus cementite is completed during cooling.

Ar_{cm}. In hypereutectoid steel, the temperature at which precipitation of cementite starts during cooling.

M_s (or Ar''). The temperature at which transformation of austenite to martensite starts during cooling.

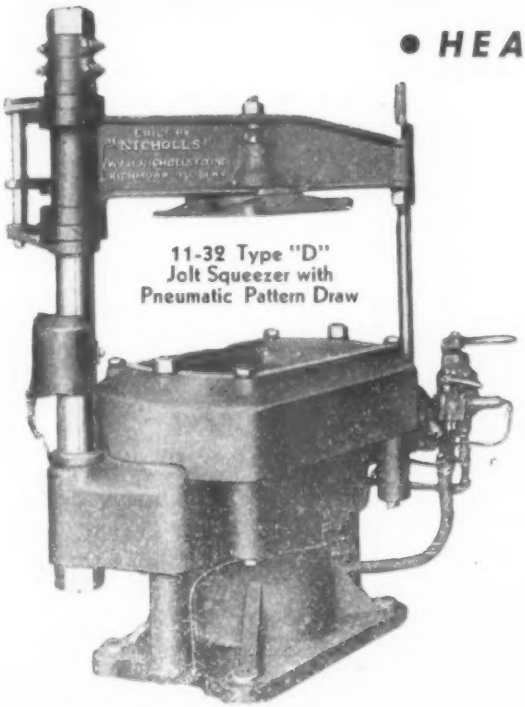
M_f. The temperature at which transformation of austenite to martensite is completed during cooling.

A_4. The temperature at which austenite transforms to delta ferrite during heating; the reverse process occurs during cooling.

NOTE: All these changes (except the formation of martensite) occur at lower temperatures during cooling than during heating, and depend on the rate of change of temperature. The temperatures of phase changes at equilibrium are denoted by the symbols Ae_1, Ae_3, Ae_{cm}, and Ae_4.

DECIMAL EQUIVALENTS MILLIMETERS TO INCHES

Mm.	Inches	Mm.	Inches	Mm.	Inches	Mm.	Inches
1	0.03937	26	1.02362	51	2.00787	76	2.99212
2	0.07874	27	1.06299	52	2.04724	77	3.03149
3	0.11811	28	1.10236	53	2.08661	78	3.07086
4	0.15748	29	1.14173	54	2.12598	79	3.11023
5	0.19685	30	1.18110	55	2.16535	80	3.14960
6	0.23622	31	1.22047	56	2.20472	81	3.18697
7	0.27559	32	1.25984	57	2.24409	82	3.22834
8	0.31496	33	1.29921	58	2.28346	83	3.26771
9	0.35433	34	1.33858	59	2.32283	84	3.30708
10	0.39370	35	1.37795	60	2.36220	85	3.34645
11	0.43307	36	1.41732	61	2.40157	86	3.38582
12	0.47244	37	1.45669	62	2.44094	87	3.42519
13	0.51181	38	1.49606	63	2.48031	88	3.46456
14	0.55118	39	1.53543	64	2.51968	89	3.50393
15	0.59055	40	1.57480	65	2.55905	90	3.54330
16	0.62992	41	1.61417	66	2.59842	91	3.58267
17	0.66929	42	1.65354	67	2.63779	92	3.62204
18	0.70866	43	1.69291	68	2.67716	93	3.66141
19	0.74803	44	1.73228	69	2.71653	94	3.70078
20	0.78740	45	1.77165	70	2.75590	95	3.74015
21	0.82677	46	1.81102	71	2.79527	96	3.77952
22	0.86614	47	1.85039	72	2.83464	97	3.81889
23	0.90551	48	1.88976	73	2.87401	98	3.85326
24	0.94488	49	1.92913	74	2.91338	99	3.89763
25	0.98425	50	1.96850	75	2.95275	100	3.93700



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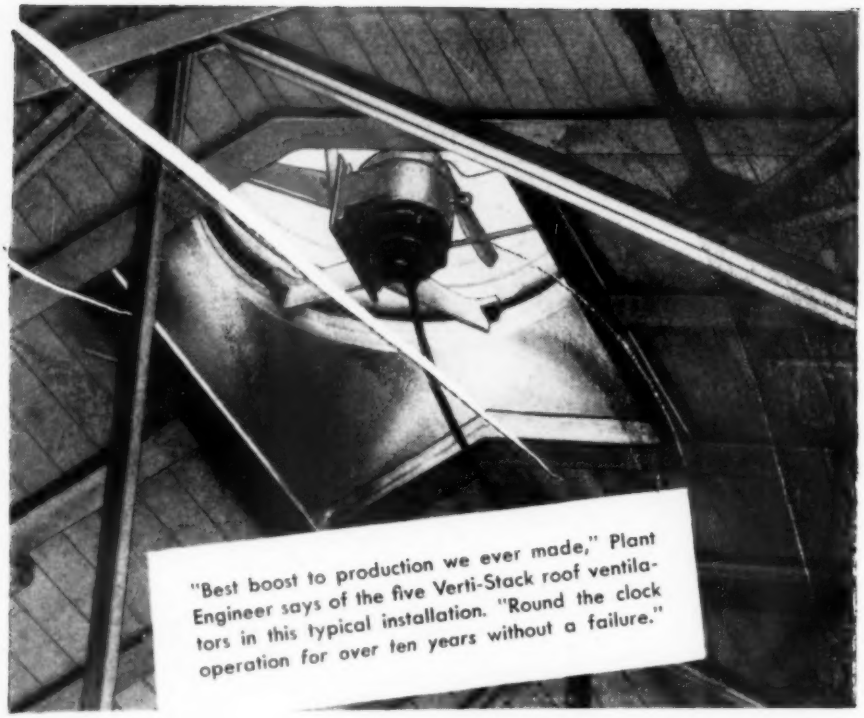
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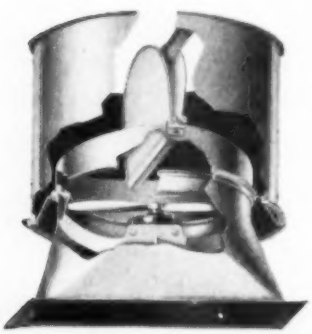

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EXPERIENCE CAN POINT WAY TO BETTER CASTINGS

(*Continued from page* 93)

comes to mind the case of a heavy steel casting which, because of defects which apparently no foundry could eliminate, was becoming a bottleneck in the production of an important piece of equipment. For a number of years various foundries had been requesting a simplification of design which would permit the production of sound castings, but they always received the answer that no design changes could be permitted. Manufacture finally fell so far behind that consideration was given to the use of forgings, as no new sources for castings could be found. Several forge shops were willing to take the job but would not attempt to make it to the casting design. The part then redesigned in accordance with the forge shops' suggestions, put into production, and was perfectly satisfactory. The new design was exactly what the foundries had been asking for all the time.

Knowledge Is Limited

Few designers know anything about the various phases of foundry technique which are required to produce a casting free from defects. Hence they are not capable of designing a part which incorporates the best casting technique. Most of them know that castings are made by pouring molten metal into a cavity in a mold, and this is about as far as their knowledge extends.

If the quality of castings is to be improved it will be necessary for the foundryman to get together with the designers and to insist upon castable designs. The time to do this is when the design has first been roughed in on the drawing board, or at least before the final assembly drawings have been completed. After the companion parts have been laid out and the finished design completed, it may be difficult to alter the design of a single part for better casting qualities without changing the whole assembly and all the other parts entering into it. Designers are as averse to doing this as most foundrymen are averse to making desirable alterations in their foundry technique once the patterns and core boxes have been built. Cooperation should work both ways, and the designer should consult with possible sources of castings when designs are in preliminary stages.

A word of warning should be inserted at this point. When changes are necessary in the design, there should be some

(*Continued on page* 208)

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(*Continued from page* 206)

assurance that the change will correct the foundry difficulties. Nothing is more disconcerting than to request a number of design changes, have the patterns changed or even rebuilt, probably at the buyer's expense, and then find that no improvement has been effected. This emphasizes the importance of knowing foundry production techniques. In case of doubt and for the sake of confidence on the part of the buyer, it might be cheaper for the foundry to make up an unmounted pattern, try it out and change it as may be found necessary, until the correct molding method has been worked out. When the problem has been solved, the necessary reworking of the regular patterns can be undertaken.

The only ideal shapes to cast are wedges, cones and pyramids, and even these are sometimes troublesome with some metals and in heavy sections. Few castings can be designed as the simple geometrical shapes mentioned. However, it often is possible to approach such shapes if care is taken in design to provide tapering sections with the heavier part in such a location that the necessary risers can be provided. When this is not possible, the foundry will have to provide padding on the pattern to simulate a wedge with the heavy end up. It goes without saying that, where possible, the design should be such that this padding will be located in the casting where it may be most easily removed, either by the foundry, using such tools as are ordinarily available for the purpose, or by the manufacturer in his regular machining setups.

Even with an ideal design, certain rules must be followed in order to produce a sound casting. The number of rules required and the care demanded in their application increases as the design becomes more intricate. The technical foundry journals and magazines have covered the subject rather thoroughly, and are continuing to report new findings in the metallurgy of the various metals and in the application of these metallurgical principles to improve foundry technique. If the foundryman thoroughly digests the reports pertaining to his particular class of work and then applies the information in his own shop, there is no reason why he should not be able to turn out satisfactory castings in most instances.

Principles Not Applied

That these principles are not being applied to the best advantage becomes evident by visiting several foundries making the same part, often from the same pattern. Frequently each one will be making it in a different manner, and each one will swear that his method is the right one, even to claiming it is the only method that will work. Surely there must be one method which is superior to all the rest. It is the author's opinion that there is a large field in the standardization of foundry methods and that it is only by such standardization that foundry procedure can become a science rather than an art. Until it does become an exact science, we may expect to encounter difficulties with defective castings. Standardization will be a rather slow process. In undertaking the problem, it will be necessary to concentrate on the simple basic designs, using all available information, and then branch out into those somewhat more complicated.

As new scientific facts are developed it will be necessary to revamp techniques, often discarding many that have been used in the past, sometimes making only small changes, but always progressing toward that point where the best foundry knowledge is applied to the production problems. A word of warning at this point might not be amiss.

The author has noted a tendency, when a new idea is presented, for many

(*Continued on page* 210)

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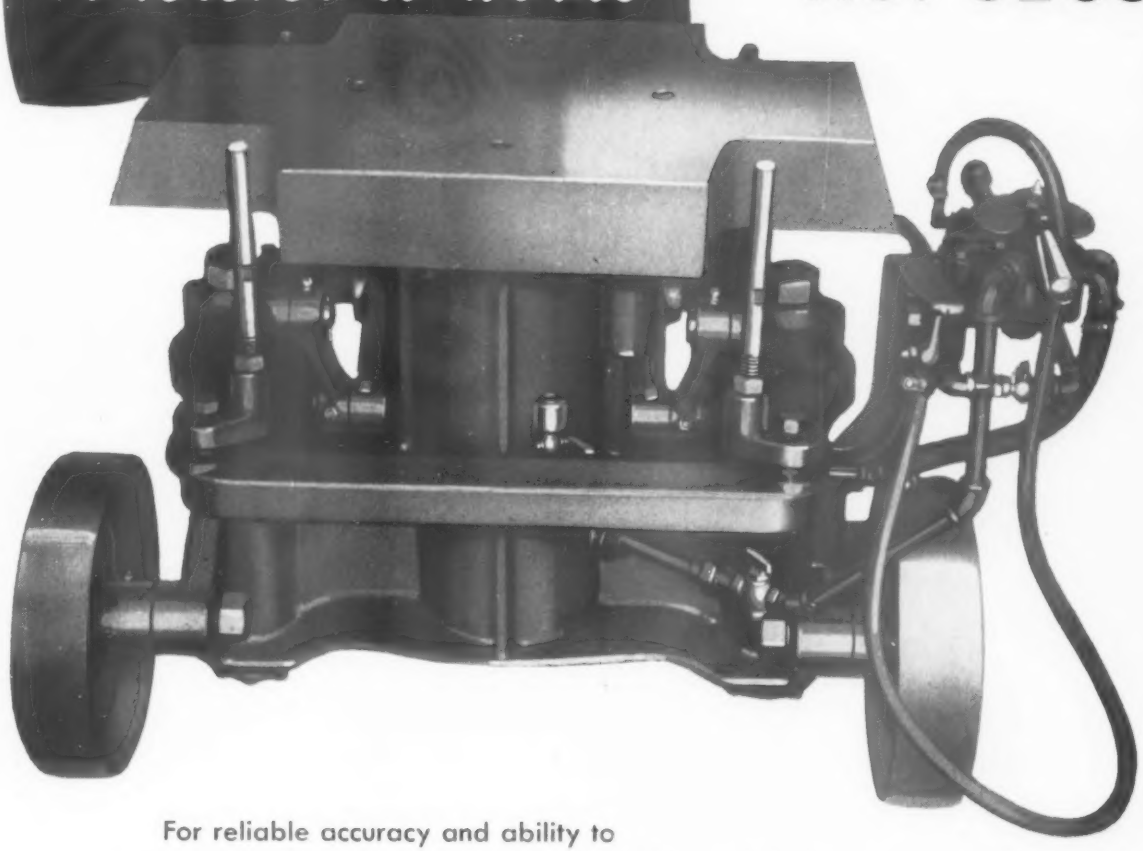

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(*Continued from page* 208)

to consider this idea as a cure for all troubles. Frequently the idea does not work out in the particular foundry for various reasons, either due to incomplete information, a misunderstanding of what was described, incorrect information resulting from insufficient testing or wrong or incomplete conclusions. As a result, the foundryman who fails in its application is likely to look askance at any further new ideas and refuse, or at least hesitate, to use them. It should be remembered that many of these new ideas have been developed in the laboratory where all conditions are ideal for their success, and often on one or a limited number of somewhat simple designs.

Before the real value of a new idea can be proved, it must be given a thorough trial in production. Such tests may show it to be of only limited applicability, useless with the equipment and personnel in the average foundry, or entirely wrong in production.

This is not intended to stifle research and development, for it is only by such research that new ideas are born. However, before any true research can become universally applicable, a considerable amount of development work must be conducted. Research usually is conducted in laboratories built for the purpose, while development must be carried out in the shop.

Many good production ideas come out of the foundries, often as a result of an employee hitting upon a way to overcome some special difficulty which had previously been a continuous headache. Such new ideas should be published so that others can work on its development, improve it if possible and make it more nearly of universal application. The little ideas often bear the most fruit, and sometimes an idea which is not sound will stimulate sufficient discussion to develop the correct answer.

Anything which helps the foundry industry as a whole will help each individual foundry. In general, the day of secret processes is past in this country. How many times has a company nursed an idea behind closed doors, later to find that it had been used by his competitors, but discarded in favor of a new and better idea? The good American system of discussing ideas with competitors is one of the reasons for the superiority of American industry.

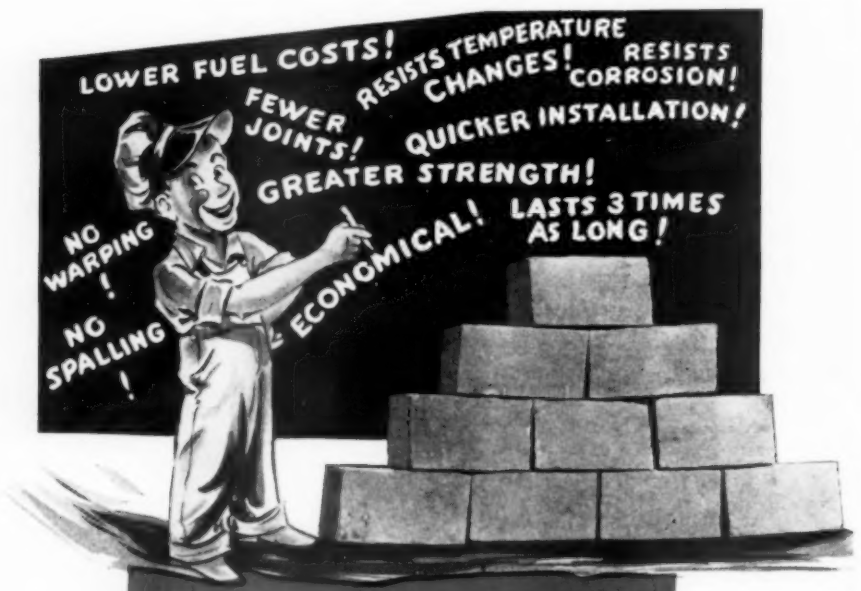
Study Develops Methods

Up to now the author has been presenting what many of us may consider is a rather idealistic view of possibilities in the foundry industry. It is his sincere belief, however, that it is not beyond the ability of any foundry having the desire to do so, to produce castings of highest quality, usually with the same equipment and without rebuilding the foundry. This statement is made with the knowledge gained by actual experience in a number of foundries.

If a foundry sincerely desires to produce quality castings and has the trained personnel which will give complete cooperation in selecting and using the right techniques, castings can be made without execessive scrap and without defects, and usually at a cost lower than previously considered possible. Usually the savings in unserviceable castings will more than make up for any extra costs which may be involved in the foundry procedures, even with the present higher costs of equipment, materials, personnel and taxes.

Foundrymen must not be like the superintendent of one foundry with which the author was connected. In making large, gray iron flanged pipe fittings, the company was experiencing approximately 80 per cent loss, which became apparent either upon removing the risers or upon drilling the bolt holes. The author was informed that this was normal scrap loss for this type of casting.

(*Continued on page* 212)



Check These Features of Buckeye Silica Firestone

Foundries everywhere are cashing in on the extra long life and efficiency provided by Buckeye Silica Firestone. For lining and patching the melting zone of cupolas, it is recommended as the finest refractory material you can use.

Realize the extra advantages of Buckeye. Send today for complete details regarding its use for your particular requirements. Our engineers will gladly cooperate in the solution of your problems.

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Bulletin 15-B gives complete information. Write!

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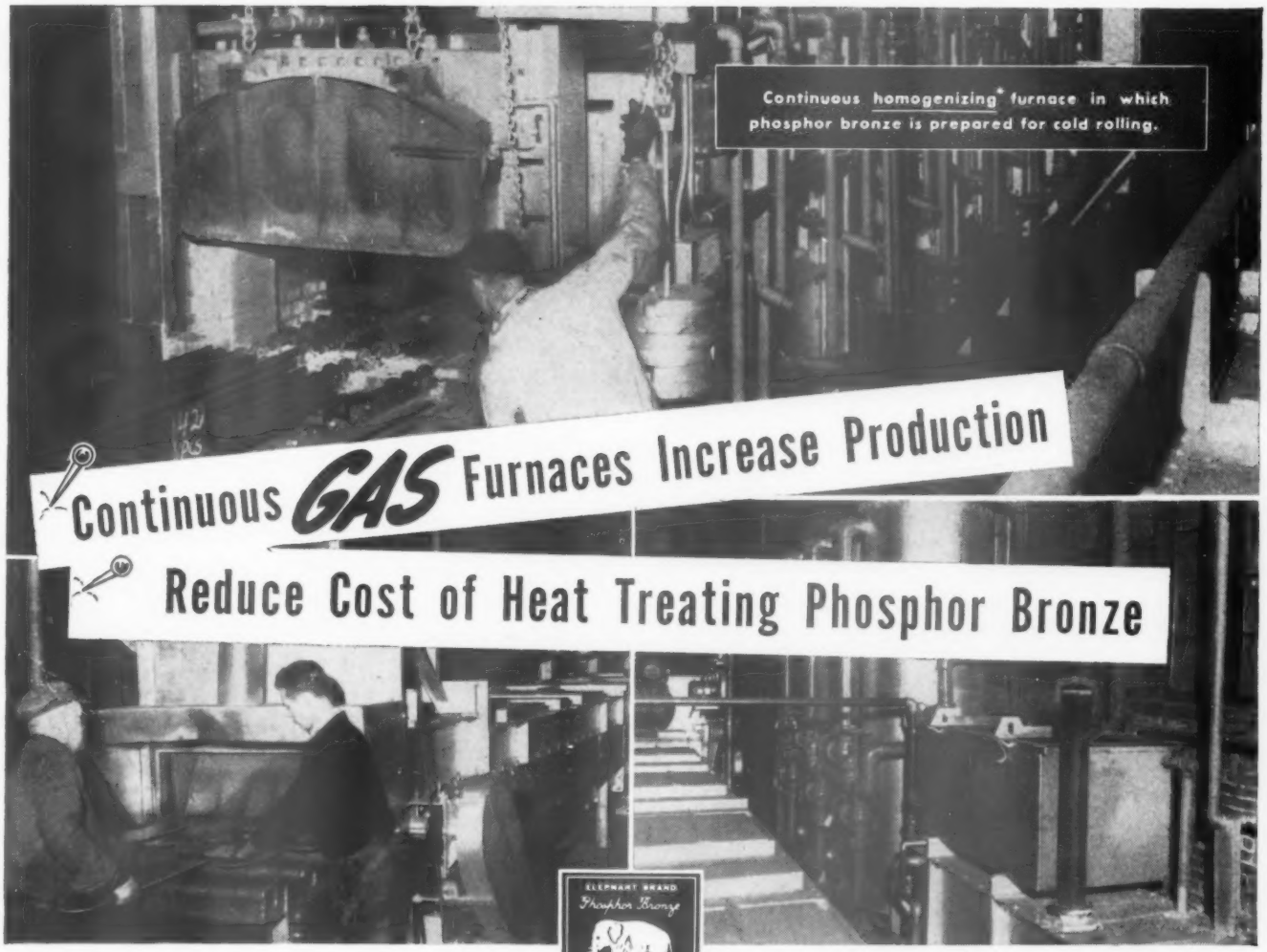


Continuous homogenizing* furnace in which phosphor bronze is prepared for cold rolling.

Continuous GAS Furnaces Increase Production

Reduce Cost of Heat Treating Phosphor Bronze

Roller hearth radiant tube heated furnace using prepared atmosphere for bright annealing.

Atmosphere generating equipment used with bright annealing furnace.

Customers of Phosphor Bronze Smelting Company, 2200 Washington Ave., Philadelphia, started the whole thing—they demanded more Elephant Brand Phosphor Bronze products than the company could produce by former methods of heat treating.

So company production engineers, already familiar with GAS and Gas Equipment, specified the modern method of heat treating—with continuous, automatically-controlled, Gas Furnaces, with integral prepared atmospheres.

Here are the processes . . .

Process—*Homogenizing—a method of heat treating to develop uniform grain structure in phosphor bronze billets prior to rolling, while relieving casting strains.
Temperature—1200° F.
Cycle—6 hours
Furnace Capacity—2000 lbs. per hour

Process—Annealing of bars and sheets in a prepared-atmosphere furnace to retain brightness while relieving stresses set up during rolling or drawing operations.
Temperature—1200° F.
Cycle—40 minutes to 3 hours, varying with stock size
Furnace Capacity—5000 lbs. per hour

Here are the results . . . .

1. Pickling process eliminated
2. Production increased 80%
3. Uniformity of heat treatment assured by automatic control
4. Annealing and homogenizing costs reduced over 50%
5. Working conditions improved

Processes and results like these are worth investigating regardless of the heat treating problem in your production line; your local Gas Company Representative can be of real assistance.

VISIT A.G.A. COMBINED METAL SHOW CHICAGO Oct. 18-24 INDUSTRIAL GAS EXHIBIT

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE... THE TREND IS TO GAS FOR ALL INDUSTRIAL HEATING

(*Continued from page* 210)

After considerable difficulty the management was prevailed upon to permit some experimentation. For two days a different type of riser was used, and no scrapped castings were produced during that time. On the third day, however, the foundry was back to using the old risers "which were standard in the industry for that type of casting."

The expression "normal scrap loss" is often heard during discussions of foundry practices. Just what is a normal scrap loss, and how is it determined? Is it the percentage determined for the whole industry for that particular type of casting, or is it the usual loss in a single foundry? It should be the hope and the goal of all to improve our foundry procedures to the point where any scrap loss at all can be considered as abnormal.

Scrapped castings are the most expensive castings that can be produced. When only one or two castings are to be made of a certain design or from a single set of patterns, the cost of a single scrapped casting becomes prohibitive. There is no place here for the usual cut and try methods. The first casting must be right. Every variable must be considered and every factor which may have a deleterious affect on the casting must be recognized and eliminated. In some cases it will be found that the right way to make a particular casting actually costs less than the method by which it previously was made. Where the casting can be produced only at a higher cost, the buyer must be trained to understand that such higher costs will be more than offset by his savings in fabrication.

Much educational work remains in the matter of costs. Only recently the author was told of a foundry which was asked by a prewar customer to bid on a lot of castings. After the bids had been sent in, this particular foundry received a letter saying that its bid was about 2 cents per pound higher than the next lower bid. The letter admitted that this particular foundry's castings had always been better than those from any other foundry, that the machining costs were lower, and the rejects were fewer; but "couldn't the price be shaded 2 cents so that we will be able to buy the castings from you?" Until such buyers learn to distinguish first costs from final costs, there can be little incentive toward improvements in foundry technique, except insofar as such improvements will cut the costs in the foundries themselves.

Variables Are Listed

As was mentioned before, there are probably more variables in foundry technique than in any other industry, any one of which may result in unsound castings if the correct principles are not applied. Some of the variables which have a direct bearing upon casting quality may be listed as: 1. Design. 2. Patterns and coreboxes. 3. Molding. 4. Melting. 5. Pouring. 6. Cleaning. 7. Inspection. 8. Repair. 9. Materials. 10. Sands or other molding materials.

Tied in with these variables and perhaps having the greatest effect upon the success or failure of any job is the question of personnel.

For successful competitive operation all variables must be considered. Unfortunately, no one has complete information on all of these variables, thereby making it absolutely necessary that all available knowledge is applied to the problem. This is not being done in all cases. For example, it should be well known that a heavy section cannot be fed through a light section, yet in all the foundries which the author has visited, he cannot recall a single case where perfect feeding conditions were provided for all parts of the mold cavity. If foundrymen are willing to take a chance on this one proved principle, what are we to expect with the other variables which are

(*Continued on page* 214)

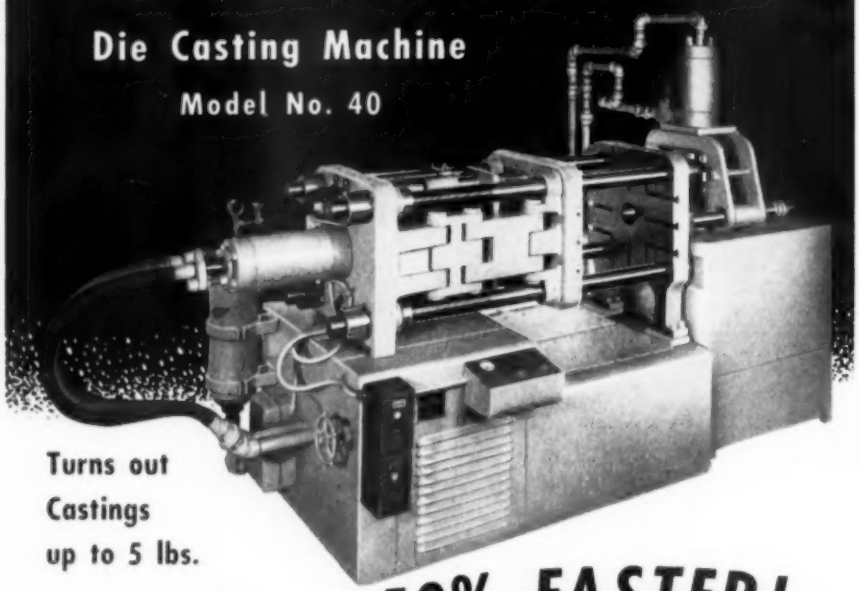
...Introducing

A REVOLUTIONARY NEW

"CAST-MASTER"

Die Casting Machine

Model No. 40



Turns out Castings up to 5 lbs.

...10% to 50% FASTER!

A "natural" for shops doing small or medium castings or shops needing a supplementary machine to handle smaller dies

Catalog and Specification Sheet available on request

A die-casting machine, designed by leading die-casting engineers, to produce light and medium castings at a rate of speed and efficiency heretofore considered impossible. Precision-built, it offers the same rigidity, the same superior construction as other famous Cast-master models ... plus added exclusive features that speed up production and cut operating costs to a NEW LOW.

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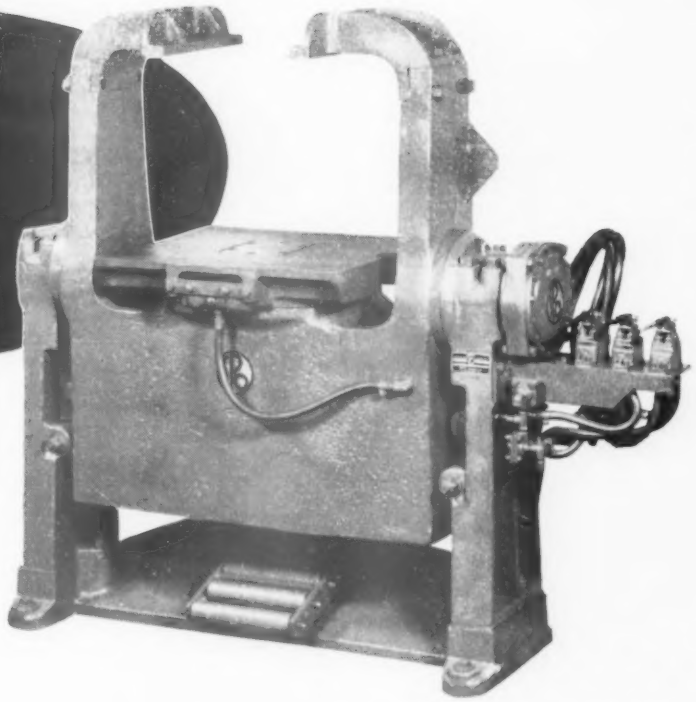
THE SPO 9000 Series

JOLT SQUEEZE-CLAMP ROLLOVER DRAW MACHINE



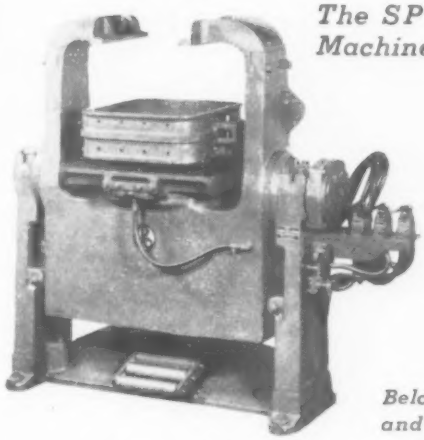
The SPO No. 9032 Molding Machine is illustrated above.

The SPO No. 9000 Series gives you the same basic advantages as you have learned to expect of all SPO Molding Machines, notably:

Simplicity of design, ease and convenience of operation, rugged construction and long life, "quick learnability", speed with accuracy. Of special interest are the following features:

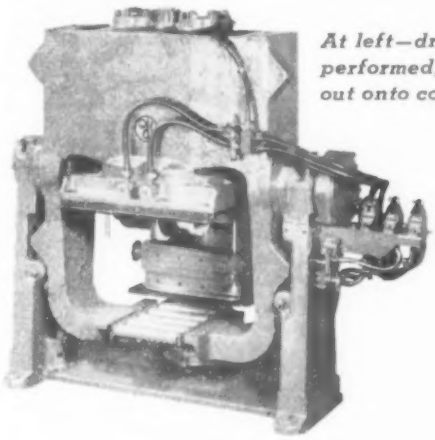
- SPO's inverted cylinder and piston construction.
- SPO's valveless adjustable jolt blow control.
- Large trunnions with heavy anvil frame.
- Adjustable 2-speed draw control.
- Air-operated brake.
- Automatic line lubrication.
- Rollover operation either hand or power operated.

We shall be glad to send you our new bulletin containing specifications.



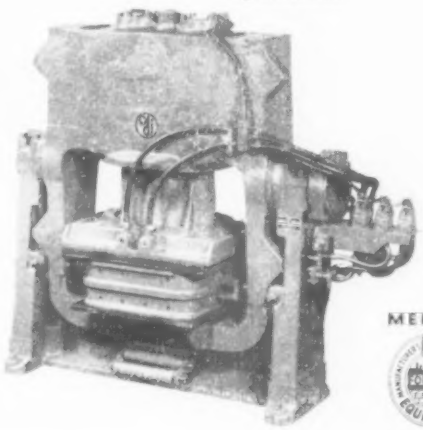
At left—flask in position ready for sand and jolt operation.

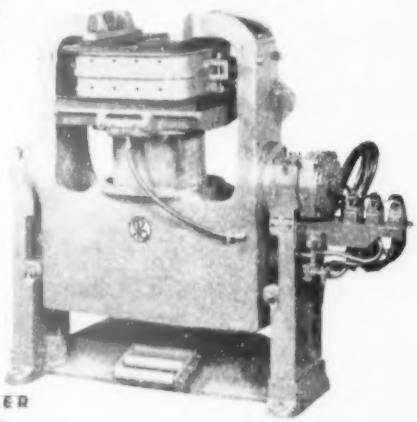
Below—bottom board and mold clamped.



At left—draw operation performed; mold pushed out onto conveyor.

Below—mold rolled over ready for draw operation.





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SPO INCORPORATED

Manufacturers and Specialists in Molding Machines, Vibrators and Patterns for Production

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(*Continued from page* 212)

not so well understood?

Many bronze foundrymen have the idea that bronze castings should be molded with the heavy part down. Of course, it is impossible to feed a casting molded in such a way, yet a large number of foundries persist in trying it. The author recalls one case where a foundryman had not obtained a single satisfactory casting for an order on which he had been working for over three months. The only change necessary to produce good castings was to reverse the pattern in the mold. Yet he would not mold them in this way. Needless to say, the job was placed in another foundry.

There is a common belief that tin bronzes are inherently subject to interdendritic shrinkage which causes sweating under pressure, especially if the chilled skin is removed by machining. This difficulty was so prevalent during the war that the Navy Department had to permit impregnation of leakers to obtain required castings. Peculiarly, after this permission was given, the number of castings requiring impregnation increased to a considerable extent. Of course, this may have been the result of poor materials, inexperienced personnel and inadequate supervision. It is true that this class of metal is subject to that type of defect and foundrymen can hardly be blamed for thinking that it is inherent.

Yet castings have been made from high tin bronzes machined on both sides, and subjected to high hydrostatic pressures without leaking. This indicates that such bronzes can be made without this defect. The only difficulty at the present time is that we don't know why some of the castings are sound while others tend to leak. This is one of the problems where research will supply the answer.

Long Solidification Range

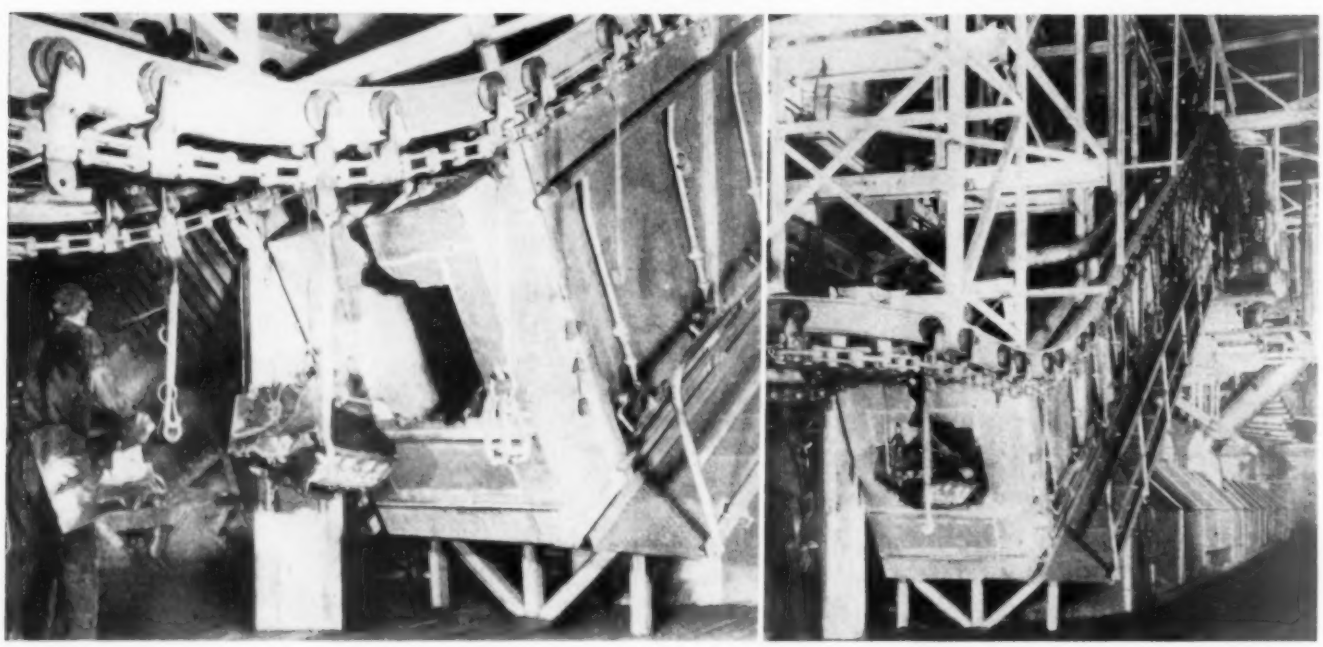
In studying the equilibrium diagram of copper-tin alloys it will be noted that these alloys have a longer solidification range than other copper-base alloys. It has been natural then to blame the shrinkage tendency upon this long solidification range. However, it has been proved that if a riser is kept open to the atmosphere until the casting under it has entirely solidified, there is no shrinkage. Certainly the metal under the riser has remained in a molten condition longer than in most castings, yet this slower cooling area is sound, thereby throwing considerable doubt upon the long solidification range being the cause of the trouble. Looking further we find that the solidification range of malleable iron and of gray iron is just as long as that of the copper-tin alloys, yet little or no difficulty is experienced from that source.

For years in electric furnace steelmaking, every effort was made to obtain complete deoxidation of the charge, even to melting under reducing conditions to keep oxygen from entering the molten metal. As a result foundry men always had difficulty with pinholes, shrinkage, and other defects as well as lack of ductility. Bessemer steel is being made every day without such defects. The bessemer process is one where it is almost impossible to remove all traces of oxygen. Taking a lesson from this process, steel now is oxidized by a vigorous boil in the electric furnace, deoxidized in the ladle and higher strengths and ductility are obtained.

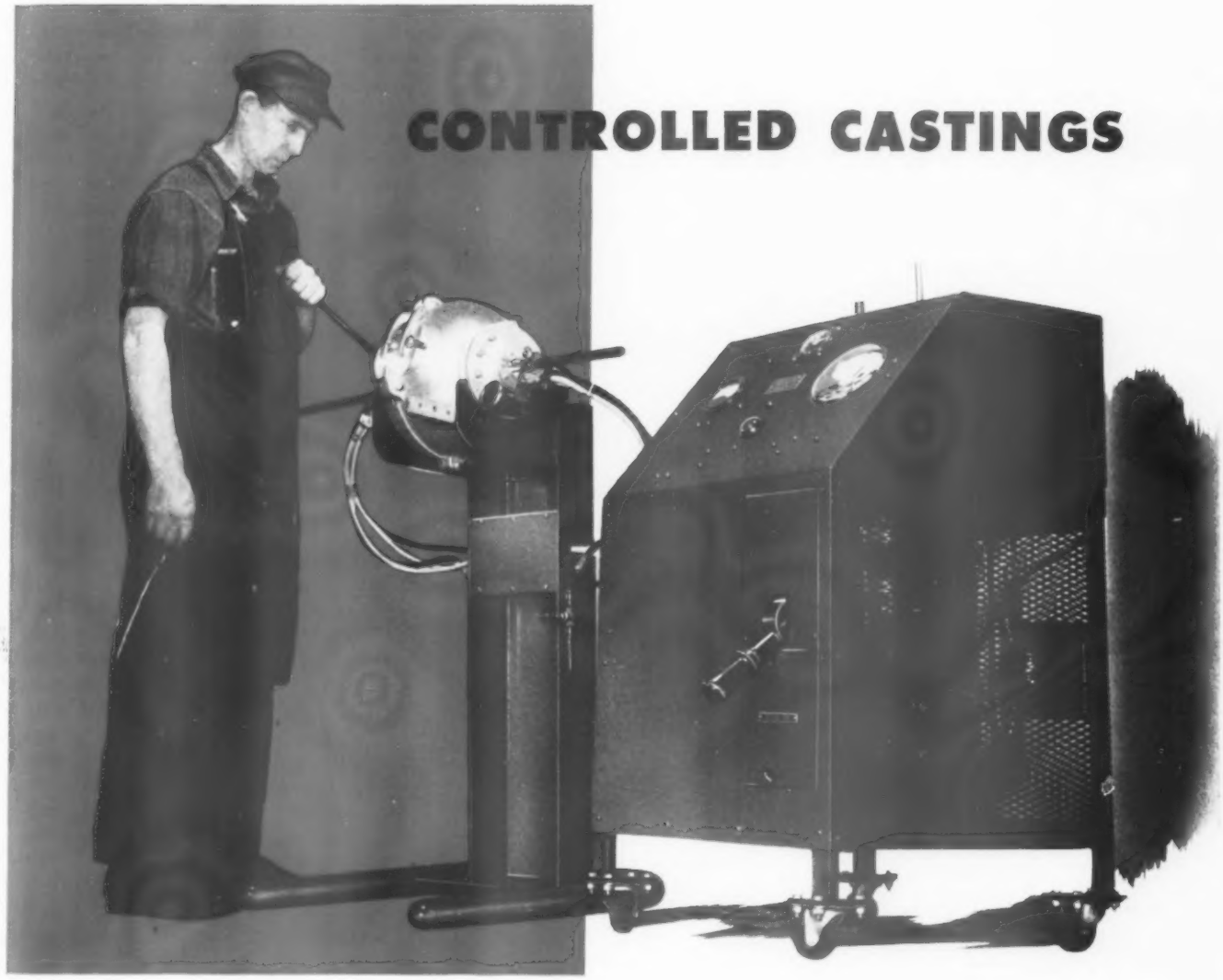
Today such oxidation is the regular practice in melting steel for castings. Tests have indicated that steel containing small amounts of oxide have better properties than those which are oxygen free. It is not likely that the whole answer lies in the presence of oxygen, however, as it is the consensus that, unknown to the older metallurgists, hydrogen was the element causing the trouble and that oxidation was the only method

(*Continued on page* 216)

ENGINE CASTINGS STRESS RELIEVED IN CONTINUOUS FURNACE



THIS continuous furnace is employed for relieving stresses in V-type automobile cylinder block castings. It has inside dimensions of 3 ft wide, 4 ft 9 in. high and 70 ft long, and the entire unit is suspended from the ceiling. The overhead conveyor provides a capacity for loading a casting every 45 seconds. Walls are 9 in. thick, consisting of 4½ in. of 2300° F insulating refractory, backed up with 4½ in. of 2000° F insulating brick. Gas fired with 40 pressure type burners, the furnace has two automatically controlled heat zones. The casting consists of steel plate reinforced with structural steel shapes. Bottom of the furnace has four clean-out doors for the removal of sand, while a catwalk running the full length on both sides of the furnace, together with two side doors giving access to its interior, have been provided for servicing purposes. Photos courtesy of Bellevue Industrial Furnace Co., Detroit.



CONTROLLED CASTINGS

Production of small pressure castings by the investment or "lost wax" process is *fast and simple* with the Type NP, 10 Kw., 10 lb. DETROIT ROCKING ELECTRIC FURNACE. The mold is clamped to the furnace spout for tapping the heat of bronze, iron, or alloy steel. The Type NP melts *6 lb. heats of brass in 6 minutes; 6 lb. heats of alloy steel in 15 minutes.* A spare shell with pouring spout can be installed for experimental work or for conventional casting. Through the self-contained power unit which is equipped with a 17 Kva. high reactance transformer, the operator has *quick, positive control over time, power consumption, and other melting factors.* Other models available up to 8000 lb. capacities for melting ferrous and non-ferrous metals. Write for complete information.

DETROIT ELECTRIC FURNACES

DETROIT ELECTRIC FURNACE DIVISION • KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

(*Continued from page 214*)

of eliminating this gas.

Perhaps if iron and other materials absolutely free of hydrogen could be obtained and these melted in an induction furnace without admitting gases or other foreign material, steel free from oxides and having high physical properties could be obtained. If such material could be obtained, it would not be possible to know that it was free of hydrogen, since no method of chemical analysis has been developed which will prove the absolute absence of that element. Lacking such knowledge, it is best to use proved methods of oxidation and deoxidation.

Steel melting probably has made the greatest strides the last few years, and more is known concerning its metallurgy than of any other class of alloys. Science of steel founding has progressed to the point where, by a study of the melting process and knowing the method of gating and risering, it is possible to form a good picture of what will occur in the casting, as well as the nature and extent of any defects. Not as much is known about nonferrous castings, especially the tin bronzes. Gray iron always has been considered rather free from shrinkage tendencies, probably because fractures have not shown what could be considered as massive shrinkage. Therefore, the tendency has been to make gray iron castings with smaller risers than are required with other classes of metal, often leaving off the risers altogether, without harmful results as shown by leakage under pressure. This assumption is valid to a certain extent if the gray iron is such as to reject the graphite at the moment of solidification, thus gaining the advantage of the expansion of this graphite which balances to a greater or a lesser extent the usual liquid to solid shrinkage.

Consider All Variables

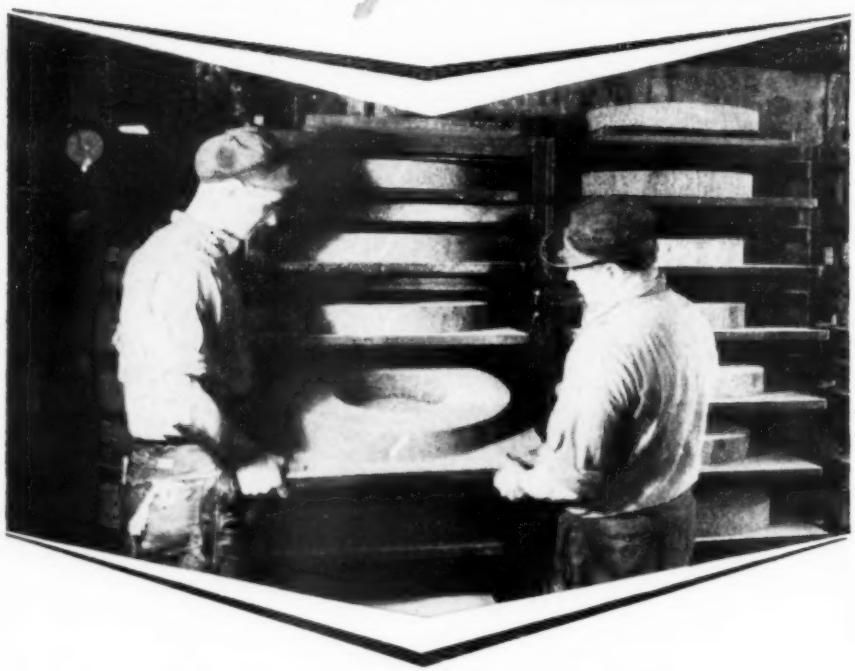
Whatever metal is being cast, consideration must be given to all variables to which the particular metal is subject. All concerned in actual production must have an opportunity to comment upon design and production methods. First it must determine if the part can be cast, whether the design should be changed and in what particulars, or if some slight changes in design will make the part lower priced to the buyer. If it is decided that the design is correct for economical production, then the correct foundry technique must be worked out *before* the pattern is constructed. Probably nothing is more expensive than building a complete set of patterns and coreboxes only to find out that the method of molding was wrong. Pattern changes are the most expensive changes which can be made during the process of determining the correct method of producing any particular casting.

Certainly it is not economical to construct an expensive set of patterns until the correct molding procedure has been developed. A less expensive soft wood pattern would serve as well, and pattern changes could be made quickly and with little expense. With small castings, the use of a plaster pattern and coreboxes is recommended because of their low cost and ease of preparation, once the proper technique has been learned. In the case of large and complicated castings, it may be impossible to determine all details of the design from the blueprint. In numerous cases the loss of the first or the first few castings may be traced to this lack of ability to realize all the details of a complicated design.

In such a case it would be economical to have the pattern shop prepare a wood or plaster model of the casting. Such a model would be a scaled-down replica of the finished casting, and could be sectioned and doweled together in such a manner that all sections would be exposed to view. With this model the lo-

(*Continued on page 218*)

"I do the job faster..."



Transite Core Plates offer all these advantages:

They speed production—Core makers save trips . . . handle many plates at one time.

They last longer—Made of fibrous asbestos and cement, Transite Core Plates resist shock . . . are less likely to crack or break.

They clean easily—Core wash, sand, etc., do not stick as readily as to other materials. Both sides are usable.

They resist corrosion and warpage—Transite Core Plate surfaces stay smooth even after long service. Warpage is less than 0.1%.

They are economical—Low price, low maintenance and long life add up to low costs.

To eliminate green cores and reduce baking time perforated plates are also available.

Johns-Manville

Box 290, New York 16, N. Y.

TRANSITE CORE PLATES MADE OF ASBESTOS

THIS FOUNDRY SYSTEM HAS BEEN GROWING SINCE 1926

During pouring time, when minutes count, is when Cleveland Tramrail equipment is especially helpful.

The first installation of Cleveland Tramrail at the Pohlman Foundry Co., Buffalo, New York, was purchased in 1926. Every few years since that time their system has been extended. More rail here—another crane there — perhaps a few chain or electric hoists.

"We here at Pohlman are pretty much sold on Cleveland Tramrail," says the foundry engineer.

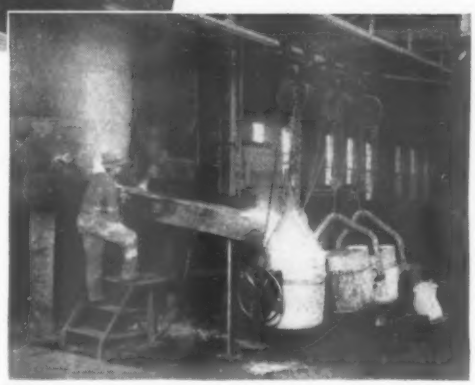
Obviously overhead materials handling equipment has proven advantageous to Pohlman. Equally obvious must be the fact that Cleveland Tramrail has been serving this company satisfactorily for more than two decades.

Cleveland Tramrail is at work in every department of this important foundry. It is especially advantageous when pouring. By means of the overhead rail system metal is easily conveyed with safety from cupola to the various floor sections and transferred to smaller pouring ladles. The latter are pushed to the molds on individual carriers.

The overhead system not only eases the work and aids safety during pouring, but it is a big factor in improving the efficiency of sand handling, mold making, shakeout, sand blast and other work.

(Above) *Keeping the small pouring ladles full is easy and safe. Scampering long distances with hot metal is eliminated.*

(Right) *Heat loss is kept at a minimum because the metal is taken directly from cupola to pouring floor quickly via the smooth overhead tracks.*



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THE CLEVELAND CRANE & ENGINEERING CO.
3809 East 286th St., Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

(*Continued from page 216*)

cation of padding and risers, the placement of necessary chills, the position of the pattern in the mold, the required gating, and necessary design changes can be determined before constructing the pattern.

It is not always desirable for patterns to be built by the buyer and then shipped to the foundry. Each foundry has its own peculiar methods, whether these methods may be right or wrong, and usually has to alter the patterns to suit the particular conditions. When the customer makes the patterns, or when they are made by a commercial patternmaker, there should be full co-operation with the foundry.

A fairly common source of loss is use of worn-out or otherwise unsuitable patterns. For example, in an order for 20 large valve castings, 18 were lost on the first run because the patterns were so badly worn they would not draw properly. This resulted in loose sand falling into the mold and remaining in the castings. The foundry did not think it was its job to repair patterns as this was done regularly by the customer. Fifteen of the 18 replacement castings also were lost for the same reason. The pattern then was sent to the pattern shop where it was put into suitable condition by one man working 2 hours. The scrapped castings were not the only loss, as it took about twice as long to do a poor job of patching as it took to make a good mold after repairs had been effected.

The subject of molding is probably the most important to the foundryman, for, regardless of whether all other conditions are under complete control, small errors at this point almost certainly will make for defective castings. Considering its great importance, there is comparatively little information on the subject. The word "comparatively" is used advisedly, as there has probably been more written on this subject than any other, yet with the immense field all that we know at present may be considered as insignificant when compared with what we should know and will know at some future date.

Require More Knowledge

What happens when metal is poured into a mold? No one has ever actually seen it, at least under the same conditions which obtain in a sand mold. Therefore, all information must be based upon theory and surmises which, in turn, are based upon observations made at some other time and place. Considering the vastness of this field, it certainly is not for the writer to dwell long upon the subject in this short article. It suffices to say, therefore, that every new idea which may be forthcoming should be of great help in bringing us nearer to the final answer which will prove some of our present theories but will just as surely disprove others.

Molding material is another subject of which we really know very little although a great amount of work has been done. We have standard sand tests and new tests are being devised, but none will give a specific answer similar to that which chemical analysis will tell concerning the exact composition of an alloy. Perhaps such specific information would be of little use. We use dry sand, baked sand and green sand molds, cement bonded sand molds, permanent molds and others, each of which has its advantages, and probably just as many disadvantages. Some foundries use naturally bonded sands, others wouldn't use anything but synthetic sands.

Considerable work has been devoted to the improvement of synthetic sands to extend their usefulness yet, so far as the author has been able to determine, no one has developed a synthetic sand which has the flowability and the property of retaining moisture at corners of the mold cavity that is possessed by the

(*Concluded on page 220*)

A SPECIAL SERVICE TO FOUNDRIES

Experience proves considerable *time and money are saved* through expert preliminary analysis, followed by correct overall planning, detailing, and installation of equipment.

If you are contemplating the mechanization or modernization of your foundry completely or in part, we invite you to have us show you case histories on what we have done for other foundries, large and small.

We specialize on foundry problems with reference to:

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(2) Foundry Consulting and Designing
(3) Engineered Foundry Systems

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The final step in any foundry system is the successful use of the system. We furnish supervision and control by capable, practical foundry engineers . . . . completely familiar with every phase of your system. Our service means that we *assume full responsibility for a complete installation*, operating to your satisfaction in accordance with your pre-determined plan.

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your present manpower can handle them All!

More orders than ever before and trained men harder to find . . . it's no time to waste available manpower preparing and blending sand. Quantity preparation of ideally conditioned sand with the Royer Sand Separator and Blender frees men for productive work . . . keeps castings rolling out to fill the orders rolling in.

One or two shovellers produce 4 to 50 tons of sand per hour, depending on the size Royer used—fits into mechanical systems, too. The Royer, with its patented combing belt, does all the work: removes refuse; breaks up lumps and clay balls; blends and mixes; opens heap; distributes moisture evenly; increases permeability; double aerates; and discharges cooled, gas-free, velvety sand under adjustable sweep.

Add to greater production these self-liquidating savings: less discount losses, less or no riddling, reduced cleaning room costs from improved casting surface quality. Send for Bulletin 744.

Royer Model NC-4 handles 12 to 15 tons per hour.

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ROYER

FOREMOST IN SAND CONDITIONING EQUIPMENT

ROYER FOUNDRY & MACHINE CO.
KINGSTON, PENNSYLVANIA

(*Concluded from page 218*)

naturally bonded sands. This single property of retaining moisture is probably the one which will be the greatest reason for retaining naturally bonded sands, although in most ways the synthetic sands have more uniformity, greater refractoriness and other properties which make them generally more suitable than the natural sands, especially in mechanized foundries.

Molders like this moisture retention as it makes patching easier. But is such patching really necessary? It occasionally is necessary to repair some part of the mold cavity which has been broken while drawing the pattern, either because of defective patterns or because of carelessness. Usually this breakage occurs at some curvature or corner of the mold where a satisfactory job of repair cannot be made anyway. Sufficient pressure cannot be exerted to assure that the sand will remain in place unless an excess of water is added. As a result we are likely to have a defect where the sand has fallen away or a blow due to excess moisture. Finally, any complicated patching usually takes as long as it would to make a new mold.

A considerable cause of defective castings is the excessive use of water around the edge of the pattern before drawing. This water is evidently considered necessary by most molders. Some are extremely generous in its use. The author has determined to his own satisfaction that, given suitable patterns, correctly tempered sand, and correct ramming, additional moisture is not required to obtain a clean draw.

The foregoing has been written, not in a spirit of criticism, but to point out some of the ways by which we can cut down defective and lost castings, and it is hoped that it will be of some help in meeting competition which is certainly going to be strong. It is hoped that what has been said will offer some incentive to others to share their ideas with the whole industry and to stimulate discussion. We all have our peculiar difficulties, and if these are aired, they will give us subjects for further research and development, which would lead to more complete knowledge concerning the many variables with which we have to deal.

THE Ajax Engineering Corporation is pleased to announce that it has acquired the exclusive license from the Scomet Engineering Company for the manufacture and sale of high-capacity, low-frequency induction furnaces.

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Issues New Foundry Equipment Catalog

Frederic B. Stevens Inc., Third and Larned Streets, Detroit 26, has just published a new catalog, which in size and completeness surpasses the previous publications of that company. In 624 pages, 60 more than were included in the previous edition, the Stevens organization describes in considerable detail its line of foundry equipment. The work is well illustrated throughout. The book has been designed to provide a reference for buyers and users of foundry equipment and supplies, buffing and polishing equipment and supplies, and electro-plating equipment and supplies.

Features pertaining to foundry operation include illustrations and descriptions of equipment and materials for cupola melting, sand preparation, molding, coremaking, nonferrous melting, cleaning, and polishing, etc.

The catalog is completely indexed for ready reference in the foundry.

Plan Annual Meeting

Annual meeting of the Society for Experimental Stress Analysis will be held at the Hotel Pennsylvania, New York, Dec. 4 to 6. Inquiries for further information regarding the annual meeting should be addressed to the society, P. O. Box 168, Cambridge 39, Mass. R. D. Mindlin of Columbia University is president of the society and W. M. Murray of Massachusetts Institute of Technology is secretary-treasurer.

USE OF OXYGEN IN OPEN-HEARTH AND ELECTRIC FURNACES

(*Continued from page 77*)

directly on the material to be heated. Therefore, attempts were made to improve the rate of charge melting by using auxiliary burners to furnish stoichiometrically correct oxy-fuel ratio flames, and by directing these flames at the charge.

A reduction of about 30 per cent in charge-to-tap time was obtained by use of these auxiliary burners on a 4-ton experimental furnace, as compared with the time required for normal practice heats in which natural gas-air burners alone were used during melting. Fuel-oxygen heats consumed 1860 cu ft of oxygen per ton of steel, and yielded a merit factor of 1.5.

Six heats were made in a 175-ton furnace equipped with burners installed in the roof. An average saving of approximately 1.6 hours in charge-to-tap time with an oxygen consumption of 200 cu ft per ton was made. The merit factor for this operation is calculated to be in the neighborhood of 5, a value in the upper portion of the range obtained when oxygen is used through end burners.

Flames Too Short

It was found, however, that the sharp, intense flames produced with the auxiliary burners were too short to be effective when stoichiometric quantities of fuel and oxygen were used. Lower velocity flames from the auxiliary burners, secured with less than stoichiometric oxygen flow, were deflected by the oil-air flame from the main burners, so that the auxiliary flame did not impinge upon the scrap, defeating the purpose of oxygen addition. When high velocity auxiliary flames were tested, the end burner flame was deflected, causing pronounced erosion of the refractories.

The installation and operation of auxiliary oxygen burners to accelerate scrap melt-down in large open hearth furnaces must still be considered an experimental technique. Further development of this method will depend upon design of practical means for mounting and mechanizing burners for roof, back wall, or front wall operation. Sufficient work has been performed, however, to show that promising reductions could be effected in charge melting times with auxiliary burner flames.

Introducing oxygen through the checkers involves no special equipment, but simply enriches the air for combustion with oxygen. Improvements claimed in performance are believed to result from increased flame radiation because of higher luminosity, and the ability to increase fuel input to the furnace because of more rapid combustion.

Oxygen injection into the open-hearth bath during refining to accelerate carbon reduction has received almost as much attention as oxygen enrichment through burners to accelerate melt-down. Injection into the bath is one of the most effective methods of utilization of oxygen, particularly in shops where large quantities of hot metal are charged, with consequent melting-in at high carbon, or where very low-carbon steels are to be produced.

Chief advantage of oxygen injection into the bath during the refining period lies in its acceleration of carbon reduction. The rate of carbon reduction achieved by normal ore practice in an open hearth averages about 0.5 points per minute. Using 100 to 300 cu ft of oxygen per ton of metal accelerates the rate by factors of 3 to 5.

The amount of oxygen required theoretically for reduction of carbon content by one point is 3.2 cu ft per ton of steel. Oxygen requirements for carbon reduction in melts producing low carbon

Designers and foundrymen, charged with the gigantic responsibility of specifying engineering materials for the products of a world once again at peace, are closely scrutinizing the widest range of selectable materials ever offered to industry. Of primary importance is the direct consideration of Performance; and, decisions thus made must, of necessity today, be tempered with new emphasis on total Cost. An alloy, therefore, which measures high in strength, toughness and corrosion resistance—which has cut its eye-teeth long ago on marine castings and fittings, engine bases, pump bodies, gears, etc.—yet permits the foundryman to produce solid castings perfectly free from surface imperfections and which leave the sand bright and clean—and will take a mirror-like polish —an alloy like that deserves investigation. A metal of such calibre is Ajax High Tensile Manganese Bronze. Produced under rigid laboratory standards to constant formulae, this Ajax ingot has established recognition as the highest quality manganese bronze available. Write for complete data NOW.

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steel actually are as low as 2.5 cu ft of oxygen per point carbon reduction. It is therefore evident that normal carbon reduction with oxygen obtained from ore charges and from the atmosphere continues during oxygen injection.

The oxidation of silicon, manganese and phosphorus in the hot metal in the standard practice is accomplished with oxygen from the ore, an exothermic reaction. The oxidation of carbon with iron ore, however, is a strongly endothermic reaction which absorbs heat from the bath. Since the heat absorbed from the carbon-iron oxide reaction more than offsets the heat generated from the other exothermic reactions, heat must be added to the bath from an external source, generally the main burners.

Most of the oxygen injection work has been performed using lengths of steel pipe (lances) to introduce the oxygen into the bath. Oxygen may also be injected into the bath with the water-cooled jet device.

A number of shops have developed methods of using pipes that have increased the life of a 20 ft long 1-in. diam pipe from several minutes as initially practiced to periods sometimes as long as 1.5 hours. Rapid replacement of pipes had characterized early work with lances. The improved procedure comprises starting flow of oxygen through the pipe at maximum rate before inserting the pipe into the furnace (thereby supplying an appreciable amount of cooling), inserting the pipe to a point just above the slag-metal interface, and using a two-wheel movable stand to reduce labor and hold the pipe in the proper position.

Although much more satisfactory performance is achieved with lances at present than was obtained in initial work, difficulties still exist because of:

1. The necessity of interrupting injection to replace pipe.
2. Hose interference with charging practice.
3. Cost and temporary scarcity of steel pipe.
4. Cleaning pipe for oxygen service.

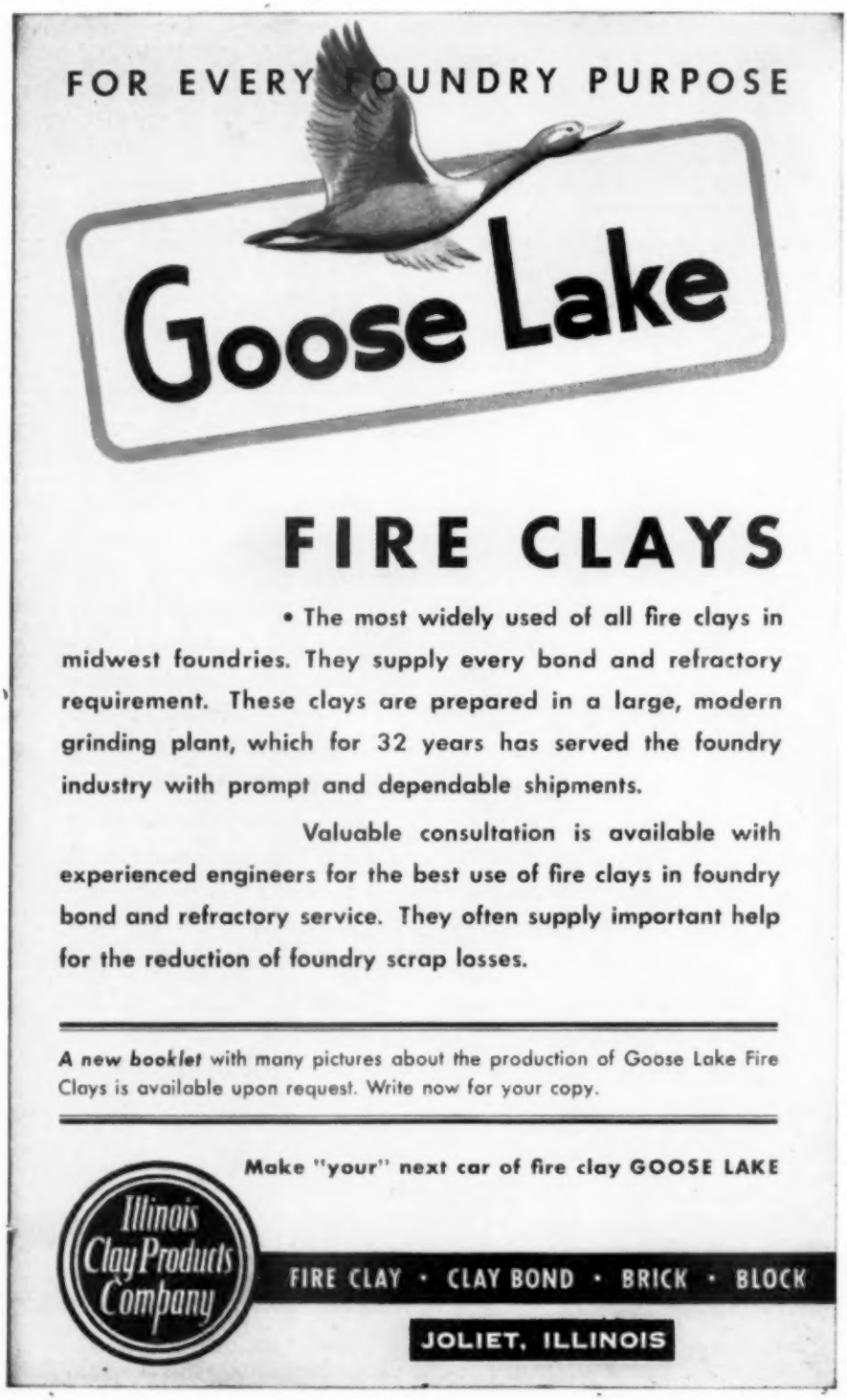
Has Some Disadvantages

In addition to these difficulties there is some reason to believe that lance oxygen injection as now practiced is not as effective as oxygen injected beneath the metal surface. Large quantities of smoke are said to be produced and splashing is reportedly increased with attendant danger to roof and wall refractories.

The jet device is usually placed in the furnace so that it is approximately 3 to 6 in. above the surface of the slag. The oxygen blown into the melt pushes the slag back and reacts with the metal below, causing violent agitation of the bath. This reaction is accompanied by the evolution of large quantities of brown fumes consisting of iron oxide, manganese oxide, and calcium silicates.

While the injection continues, the bath begins to boil and bubble over its entire surface due to the rapid formation of large quantities of carbon monoxide shortly after the beginning of the oxygen injection. The slag becomes foamy as in a rapid ore boil, and frequently overflows the door banks unless they are built higher than usual. As the refining progresses, the slag level gradually subsides and the bath temperature rises. While heat input from the main burners is customarily reduced from about one-half normal fuel flow at start of oxygen injection to zero as the bath and furnace gain temperature, better results might be secured by reducing temperature with ore additions, thereby attaining further increased carbon reduction with increased yield. By the time a low-carbon composition desired for tapping is reached, the bath is comparatively quiet, with very small bubbles scattered generally over the bath.

For initial experiments, a simple installation through the charging door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wicket hole is generally used to initiate oxygen jet injection. Permanent installation requires individual consideration in each plant because of widely varying conditions. Consideration should be given to roof, back wall, front wall, and possible end wall location of the jet device using remote controlled or manually operated mounting mechanisms.

Enough campaigns have not been run to determine the effect of oxygen injection upon the life of refractories, although experience to date has indicated that this life will not be adversely affected if burners are used properly. Lance injection of large quantities of oxygen in a few hot metal shops has impaired the life of roof refractories, most of the trouble having resulted from slagging the roof with quantities of molten iron and slag thrown onto the roof by the extremely vigorous splashing caused by lance injection.

The production of large quantities of smoke during refining with oxygen injection and charge melting by directing oxygen at preheated scrap constitutes one of the major problems of oxygen use. Considerable success in smoke elimination has been achieved by the installation of simple dust collectors in the flue system. Interference to air flow through checkers from dust deposits was reduced by changing checker construction to provide additional gas space and further improvement results from more frequent checker blowing with changes in blowing procedure to improve dust removal. Improved methods of oxygen injection which cause less formation within the open hearth proper will lead to further reduction in smoke.

Electric Furnace Practice — Use of a lance for the introduction of oxygen into the electric furnace has long been known. Like the open-hearth the electric furnace process comprises two major periods—melting of the charge and refining. It is found that oxygen may be used to shorten the melt-down period by injection at an early stage of the heat, and it may further assist in superheating as required for the optimum initiation of the refining period. In the refining period the use of oxygen increases the rate of carbon elimination and thus decreases total refining time. The major advantages of oxygen injection then are to shorten both the melt down and refining periods.

Installations using pipe lances or jet devices to inject oxygen into the bath are similar to the methods employed in the open hearth furnace for reduction of the decarburization period. A typical installation for the experimental use of the jet device is shown in Fig. 2.

Use of oxygen injection for carbon removal has become standard practice in some electric furnace shops. In normal practice a steel lance is inserted into the bath until the end of the pipe is located at the interface between the metal and the slag, a method requiring several 20-ft lengths of pipe per heat.

During jet device oxygen injection, the equipment is inserted into the furnace until the nozzle is pointed at the deepest portion of the bath with the tip of the head held from 3 to 6 in. above the slag surface. Generally, this means that the jet is located between the electrodes, with the oxygen stream directed away from the electrodes to minimize electrode oxidation. None of the tests to date have shown any increase in electrode consumption beyond normal practice. Both the jet and the lance are left in one location for the duration of the carbon removal period, after which they are removed to permit normal deoxidizing or processing of the melt.

Most of the oxygen used to date in electric furnaces has been injected into either straight low-carbon steels, or high-chrome steels, where some chromium has been included in the charge. Results of a number of heats with lances and jets in 30- to 70-ton electric furnaces

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indicate that carbon reduction rates of 0.5 points per minute for chrome steels are readily achieved, and that carbon reduction rates of 1.0 point per minute, or better, are possible when treating plain low-carbon steels. Considerable savings in power consumption are common.

The oxygen utilization efficiency in alloy heats, based on carbon reduction, lies in the range of 10 to 20 cu ft of oxygen per point carbon reduction per ton of ingot metal. No injurious effects of oxygen injection refining methods upon the steel have been noted. Increases in rate of production up to 13 per cent have been obtained with a considerable saving.

In special instances of experimentation with high alloy heats, it has been noted that the amount of alloy oxidized into the slag for a given carbon drop by means of oxygen has been somewhat lower than when the carbon drop was effected with ore. This may be due to increased temperature and improved control.

Results Are Summarized

A summary of results obtained with oxygen injection in electric furnaces is given in the accompanying table.

The chief disadvantage associated with the use of oxygen injection in the electric furnace appears to lie in the excess smoke created, although most shops do not find this a real objection. A minor disadvantage in chromium steel heats is the refractory chrome oxide build-up on the end of the jet requiring removal either by sledging the deposit after it has cooled, or by fluxing it down to small weight while in the furnace.

Oxygen Supply—If oxygen for metallurgical uses is applied generally, unprecedented quantities, possibly of lower purity than is now standard, will be required—and at a delivered cost within economic limits. Steps already have been taken to meet this demand.

The oldest and probably the most familiar method of oxygen distribution is in the form of a compressed gas in standard steel cylinders, holding up to 244 cu ft of gas at 2200 psi pressure. Such cylinders still are the only practical means of oxygen supply for applications at temporary and widely scattered points or where total consumption is not large, but obviously they are inadequate for large-scale requirements. As demand for oxygen increased steadily the last 10 to 20 years the problem of supply and distribution was solved by the development of producing equipment from which the oxygen could be drawn as a liquid, and by providing storage tanks and transport containers having sufficiently good insulating properties to hold this liquid

(*Concluded on page* 226)

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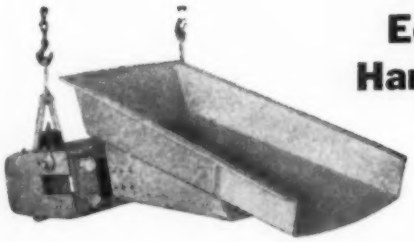

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(*Concluded from page 224*)

at a temperature of −297 F with a minimum evaporation. This meant considerable saving in storage and transportation facilities, since the ratio in volume of oxygen as a gas to that as a liquid at normal temperature and pressure is 862 to 1.

Liquid oxygen now is transported in both specially designed tank cars and trucks. At the consuming plant this liquid oxygen is converted for use by either of two different methods. In what is known as the Driox system developed by The Linde Air Products Co., the oxygen is delivered and stored as a liquid in a stand tank on the user's property; it is then converted by special equipment to gaseous form as required. In Linde's so-called Cascade system (Fig. 5) the liquid oxygen is delivered in a tank truck provided with converting equipment which changes the oxygen into gaseous form and charges it into large receiver tubes at the user's plant. Choice of system used depends upon the consumer's requirements, the latter usually being employed when consumption is approximately 50,000 to 750,000 cu ft per month, and the former when demand for oxygen is more than 750,000 cu ft.

Liquid Oxygen Delivery

At present the liquid oxygen delivery system is being used to a large extent for experimental work on open-hearth and electric furnaces, but if it should appear that future demands for this purpose cannot be met by this method, it may well be that individual gaseous oxygen plants of large capacity may have to be installed at certain specified locations. Development of such plants already is under way, the Linde company for more than eight months having operated a pilot-size unit of this type. It is said to be the largest single unit for producing gaseous oxygen ever built, having a capacity of about 4,800,000 cu ft per day of 90 per cent purity oxygen. Capacity in gaseous equivalent of existing liquid oxygen producing plants is more than double this figure. The latter plants, however, are producing high-purity liquid oxygen from several individual units which are installed in each plant.

Before individual gaseous oxygen producing plants are adapted to the consumer's plant various factors must be determined. The most important of these, some of which will require further experimental work to supply the answer, include: The most effective oxygen purity; quantity and pressure of oxygen required and extent of variation in demand; the metallurgical uses which are economically attractive; and extent to which continuity of oxygen supply must be assured.

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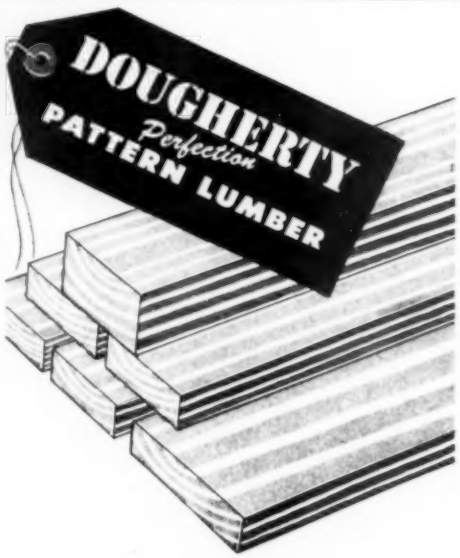

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LUMBER COMPANY

CONTROL OF GRAIN SIZE IN MAGNESIUM CASTING ALLOYS

(*Continued from page* 81)

During the course of an investigation at the National Bureau of Standards of the influence of melting and casting conditions on the properties of magnesium castings, a procedure for grain size control was devised which appears promising because of its simplicity. The procedure consists of treating the molten alloy with magnesite in lump form. In this paper a comparison is made of the results obtained when magnesium alloy melts are superheated, treated with solid carbonaceous materials, with carbon monoxide, or with lump magnesite.

Equipment and Procedure — Most of the melts were made in a high frequency induction furnace (960 cycles). The crucibles were of cast steel, 13 in. high and 10½ in. OD with a wall thickness of ½-in. The use of steel crucibles diminished the usual "coning up" of the molten charge in the high-frequency furnace and permitted the maintenance of an adequate flux cover on the melt. For comparison, a few melts were made in a gas-fired furnace with a steel crucible, and one special heat was made in a silicon carbide crucible in the high-frequency furnace.

Temperature measurements were made with an 18-gage chromel-alumel thermocouple, encased in a closed-end steel tube with an outside diameter of 5/16-in. and a wall thickness of 0.025-in. The melting procedure was as follows:

A small quantity of flux—a commercial product known as D-310 of the following composition: $MgCl_2$, 50 per cent; KCl, 20 per cent; CaF_2, 15 per cent; MgO, 15 per cent—was placed in the cold crucible, the metal charge was introduced, and additional flux was added as required during the melting. At approximately 730°C, the molten metal was stirred and the surface dross was removed. In the superheating treatment, flux was added and the temperature was raised to 900°C. This temperature was maintained for 15 minutes, after which the crucible was removed from the furnace and the melt cooled to the pouring temperature (760°C).

In the case of other treatments, the additions were made in the range from 730° to 750°C and flux was added as necessary to avoid excessive oxidation. The temperature was then increased to between 760° and 800°C, after which the melt was cooled to the pouring temperature. All castings were poured at 760°C, and during this operation the

(*Continued on page* 230)

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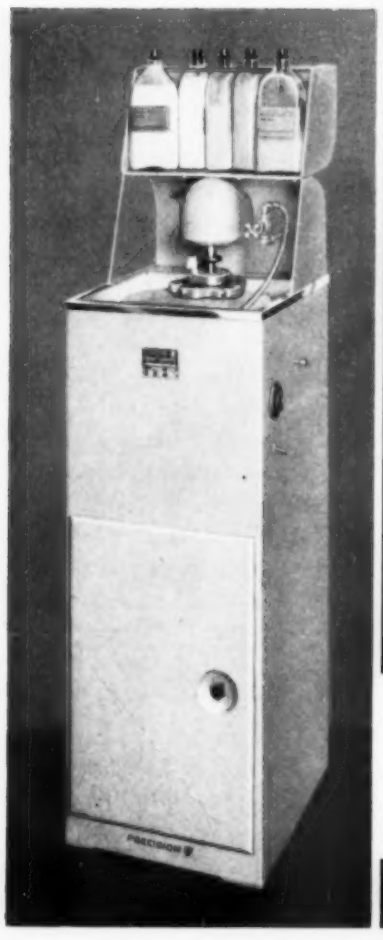

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(*Continued from page* 228)

stream of metal was protected by the use of a dusting flux consisting of powdered boric acid and sulphur.

The castings were made in green sand molds, prepared from a sand formula suggested by Eastwood.[8] The mixture was as follows:

	Per cent
Washed silica sand (AFA fineness No. 80)	91
Western bentonite	4
Powdered sulphur	3
Powdered boric acid	1
Ethylene glycol	1

After thorough mixing, tempering with 2.5 per cent of water and mulling, this sand had the following average properties: Hardness, 84; permeability, 67; green compression strength, 8.8 psi.

The mold surfaces were generally dusted lightly with powdered sulphur before the molds were closed.

The castings used for grain size evaluation and for measurements of the tensile properties were tensile test bars of two types. The first were ¾-in. diameter cylindrical bars, that were subsequently machined into standard 0.505-in. diameter tensile test bars. Bars of the second type were cast to this shape and dimension and were tested without machining.

Grain size determinations were made on a transverse section of a test bar from each heat. To outline the primary crystals, the specimens were held at 385°C for one hour, cooled in an air blast, and etched with acetic picral etchant. This etchant consisted of 100 ml of a freshly prepared solution of saturated picric acid in 95 per cent alcohol to which was added 10 ml of glacial acetic acid. Tests showed that the slight difference in diameter of the two types of test bars as cast did not affect the grain size appreciably.

The estimation of grain size was accomplished by comparing the microstructure at 100 magnifications with a chart[9] of structures with different average grain diameters. In the extremely coarse structures the approximate grain size was measured under low power magnification.

The tests were performed on ASTM Alloy No. 4, a magnesium alloy widely used for general purpose sand casting. The nominal composition of this alloy is as follows: Aluminum, 6 per cent; zinc, 3 per cent; manganese, 0.2 per cent; balance, magnesium.

Experimental:

1. Treatments for Grain Size Control —Two melts were made to illustrate the coarse grain developed in the absence of any special treatment. In these runs, the 25-lb melts were stirred, skimmed, and heated to about 785°C, cooled to

(*Continued on page* 232)

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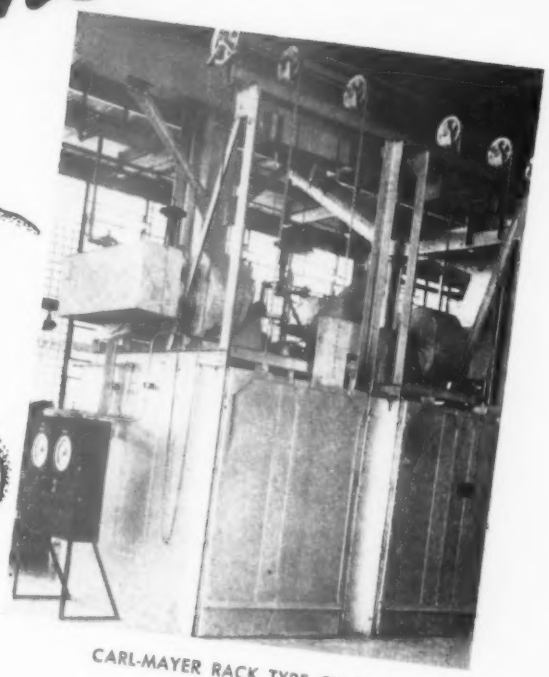

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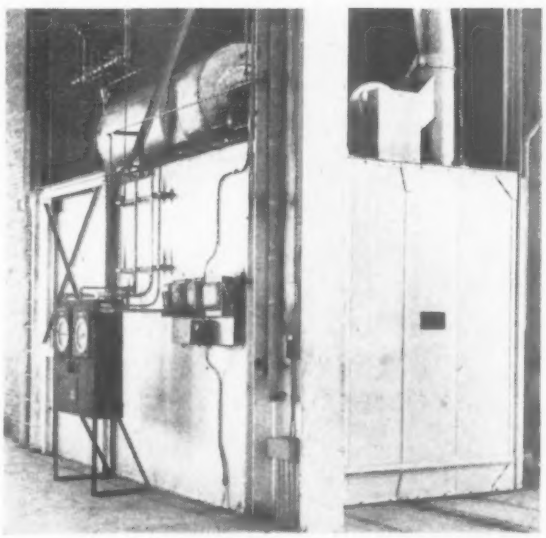

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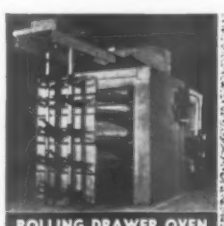

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CORE AND MOLD OVENS

(*Continued from page* 230)

760°C and poured. When the melt was made in the high frequency induction furnace (melt No. 1 of the accompanying table) the cast test bars had an average grain size of 0.05-in., whereas in a duplicate melt (No. 2) made in a gas-fired furnace, the average grain was 0.02 in. in diameter. It is possible that the finer grain of the latter may have been caused by absorption of carbonaceous gas from the furnace. However, the ultimate tensile strengths, 20,900 and 23,100 psi, are both characteristics of coarse-grained castings.

The effect of superheating to 900°C is shown in the results of melts 3, 4, and 5, as shown in the table. Superheating produced a uniformly fine grain of 0.004 and 0.005-in. diameter regardless of whether the melt was made in the gas or induction furnace or whether the charge consisted of virgin or remelted metal. The results of the tensile tests illustrate the tendency toward somewhat higher values on cast-to-size bars over those that were machined. The ultimate tensile strengths for the machined bars from melts 3, 4, and 5 were nearly all in the range of 26,000 to 27,000 psi, whereas the values for the cast-to-size bars of melt 5 were approximately 3000 psi higher. The higher values obtained on the cast-to-size bars are probably due to the presence of a fine-grained surface layer or skin that is removed in the preparation of the machined specimens.

A study of the effectiveness of carbonaceous additions to the metal was made in melts 6 to 10, inclusive. The additions were made at 730-750°C, after which the melts were heated to 800°C and then cooled to the pouring temperature as recommended by Mahoney, Tarr and LeGrand[8]. The additions of from 0.2 to 0.8 per cent of graphite to the melt were stirred in vigorously for three minutes. Small additions of flux were necessary to avoid burning in this operation. Neither the granular graphite (10 to 20 mesh) nor the powdered graphite (finer than 100 mesh) had the desired effect on the grain size of castings from melts 6 and 7 (average diameter, 0.030-in.).

In contrast to these melts made in the induction furnace, the addition of granular graphite to melt 8 in the gas-fired furnace produced a smaller grain size (0.014-in.). This again may be an effect of furnace atmosphere, as suggested previously for melt No. 2. It is believed that the relatively large grain size of the castings from melts 6, 7 and 8 was caused by inadequate contact between the molten alloy and the graphite particles, a condition that might be aggravated by the presence of liquid flux during the

(*Continued on page* 234)

HIGH MANGANESE METAL

(*Concluded from page* 85)

chrome brick or some other special refractory at the tuyeres and slag line. That feature of the problem, however, was never dealt with, since the introduction of the electric steel melting furnaces into steel foundries soon took care of the problem of utilizing manganese steel scrap, and in most cases even eliminated the converter as a steelmaking unit.

Details of the various blows follow:

Blow No. 1—Nov. 17, 1913

CUPOLA CHARGE

Item	Wt	Si %	Mn %	Si lb	Mn lb
Mn. steel scrap	2100	0.30	12.00	6.30	252.00
Pig A	2100	3.97	0.32	83.37	6.72
Pig B	445	2.07	0.30	9.21	1.34
Cast steel scrap	255	0.30	0.75	0.77	1.91
Total	4900	2.03	5.34	99.65	261.97

HISTORY OF BLOW		ANALYSIS	Cupola Metal	Steel
Tap—4500 lb				
Blast on	2:55 p.m. (3.75 psi)	C	2.55	0.29
Blast off	3:08 p.m. (To clear tuyeres)	Si	1.90	0.21
Blast on	3:10 p.m.	Mn	4.18	0.74
Light	3:11 p.m. (3.5 psi)	P	0.084	0.076
Mild boil	3:19/3:21 p.m. (2.75 to 3 psi)	S	0.017	0.017
Final flame	3:22 p.m.			
Drop of flame	3:25 p.m.			
No boiling over at any time				

Blow No. 2—Dec. 8, 1913

CUPOLA CHARGE

Item	Wt lb	Si %	Mn %	Si lb	Mn lb
Mn steel scrap	1780	0.30	12.00	5.34	213.6
Pig No. 1	840	5.14	0.30	43.18	2.52
Pig No. 2	840	4.13	0.32	34.69	2.69
Billet crop ends	1840	0.10	0.50	1.84	9.22
Total	5300	1.61	4.30	85.05	228.03

HISTORY OF BLOW		ANALYSIS	Cupola Metal	Steel
Tap—4900 lb				
Blast on	3:37 p.m. (3.75 psi, 7° inclination)	C	2.18	0.25
Light	3:44 p.m.	Si	1.48	0.17
Slight boil	3:48/3:50 p.m.	Mn	2.97	0.63
Hard boil & slop	3:52/3:54 p.m.	P	0.046	0.052
Blast off	3:54 p.m. (500 lb metal added)	S	0.07	0.042
Blast on	3:57 p.m.			
Small boil	3:58 p.m.			
Final flame	4:00 p.m.			
Drop of flame	4:03 p.m.			

Blow No. 3—Dec. 15, 1913

CUPOLA CHARGE

Same as for Blow No. 2

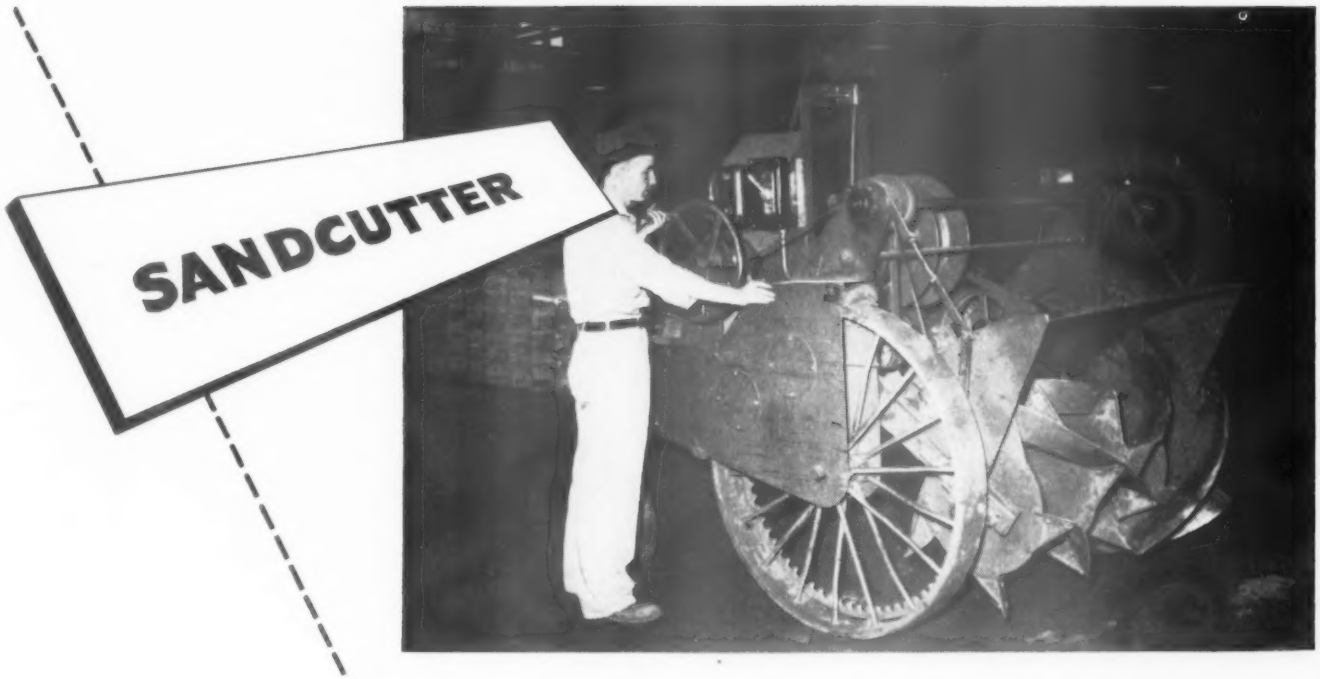
HISTORY OF BLOW		ANALYSIS	Cupola Metal	Steel
Tap—4600 lb				
Blast on	2:55 p.m. (3 psi, 8.5° inclination)	C	2.21	0.33
Light	3:00 p.m. (7.5° inclination)	Si	1.28	0.26
Turn up	3:01 p.m. (3.5 psi, 6.5° inclination)	Mn	2.90	0.94
Turn up	3:02 p.m. (6° inclination)	P	0.054	0.055
Turn up	3:05 p.m. (5° inclination)	S	0.07	0.035
Hard boil	3:06/3:07 p.m. (2.75 psi)			
Blast off	3:07 p.m. (600 lb metal added)			
Blast on	3:09 p.m. (3 psi)			
Hard boil	3:10/3:11 p.m. (2 psi)			
Hard boil	3:12 p.m.			
Hard boil	3:14 p.m.			
Final flame	3:15 p.m.			
Drop of flame	3:17 p.m.			

Blow No. 4—Mar. 9, 1914

CUPOLA CHARGE

Item	Wt	Si %	Mn %	Si lb	Mn lb
Mn steel scrap	2100	.30	12.0	6.30	252.00
Pig A	2475	3.97	0.32	98.27	7.92
Pig C	325	2.37	0.23	7.70	0.75
Cast steel scrap	400	0.30	0.75	1.20	3.00
Total	5300	2.14	4.97	113.47	263.67

HISTORY OF BLOW		ANALYSIS	Steel	Cupola Metal
Tap—4700 lb				
Blast on	3:09 p.m. (3.25 psi, 8° inclination)	C	0.34	(Not analyzed)
Turn up	3:18 p.m. (7° inclination)	Si	0.26	
Light	3:18 p.m.	Mn	0.62	
Turn up	3:19 p.m. (6° inclination)	P	0.067	
Lost flame	3:20 p.m.	S	0.019	
Turn up	3:21 p.m. (regain flame, 5° inclination)			
"Spitting"	3:23 p.m. (3.75 psi)			
Turn up	3:24 p.m. (4° inclination)			
Turn up	3:26 p.m. (3° inclination)			
Slight boil	3:27 p.m.			
Turn up	3:27½ p.m. (2° inclination)			
Slight boil	3:28/3:29 p.m. (2.5 psi)			
Turn up	3:29 p.m. (½° inclination)			
Slight boil	3:30/3:31 p.m. (2.25 psi)			
Final flame	3:33 p.m.			
Drop of flame	3:35 p.m.			



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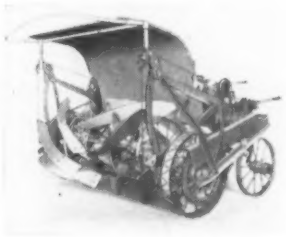

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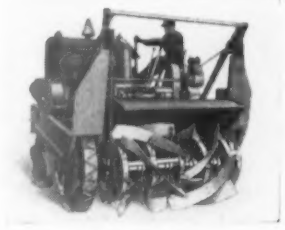

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(*Continued from page* 232)

treatment.

Another procedure that has been suggested for obtaining better contact between the molten magnesium alloy and a carbon compound consists of melting in a silicon carbide crucible. This was tried in melt 9 and the resulting castings indicated a grain size of 0.006-in. This procedure might be promising except that the flux tends to penetrate and weaken the walls of the crucible.

The effectiveness of carbon monoxide treatment was demonstrated in melt 10, in which the gas was bubbled through the molten metal for five minutes at about 750°C. This treatment produced a grain size of 0.005-in. and the tensile properties were equal to those obtained from superheated metal. These results are in agreement with those obtained by Nelson and Holdeman.[5] Apparently some of the carbon monoxide is reduced by the hot magnesium to form nascent carbon, the distribution of which throughout the melt is aided by the agitation produced by the gas bubbles. Carbon dioxide has been shown[3, 5, 6] to be effective in the same manner. This gas can be generated by placing lumps of magnesite in the melt, thus eliminating the need for any special apparatus for the gas treatment.

Magnesite Evolves Carbon Dioxide

The use of magnesite as a source of carbon for controlling grain size in magnesium castings was reported by Mahoney, Tarr and LeGrand[6], who apparently used it in the same manner as other carbonaceous materials, that is, by stirring the powder into the melt. Natural lump magnesite, which has a specific gravity between 2.8 and 3.1, decomposes in the range of 200°-750°C,[10] and evolves carbon dioxide.

In order to evaluate the usefulness of lump magnesite for the control of grain size, white California magnesite was used in a series of experiments. The regular melting practice was followed, using a steel crucible in the high-frequency furnace.

The results for grain size control through the use of magnesite are illustrated in melts 11 to 22. In melt 11, approximately 75 g of magnesite, pea size and smaller, was added, but these small pieces remained on the top surface of the melt without the desired action. When a lump about an inch in diameter was added it sank into the melt at once and evolved carbon dioxide, which bubbled up to the surface. A thin flux cover was applied and the decomposition of the magnesite continued for several minutes. The castings were poured at the usual temperature. Subsequent tests in-

(*Continued on page* 236)

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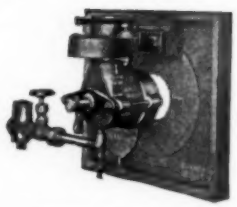

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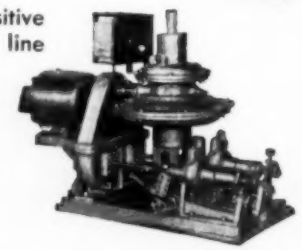

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ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

(*Continued from page* 234)

dicated an average grain size of 0.005-in., and tensile properties equivalent to those obtained by superheating.

Additional experiments showed that in some instances the gas evolution tended to float the magnesite, thus limiting the effectiveness of the gassing. This problem was solved by placing the magnesite, generally pieces about ¾-in. diameter, in a perforated sheet iron container that could be held at the bottom of the crucible. Fifty grams of magnesite was sufficient for the control of grain size in melts ranging from 18 lb to the capacity of the crucible, 45 lb, and was equivalent to 0.25-0.60 per cent of the weight of the charge. Treatment with less than 25 g of magnesite was inadequate even for a small charge. The procedure ultimately adopted was to stir and skim the melt at 730°C and immerse the magnesite for 5 minutes with flux additions as required. The temperature then was raised to 760°C and the metal was poured.

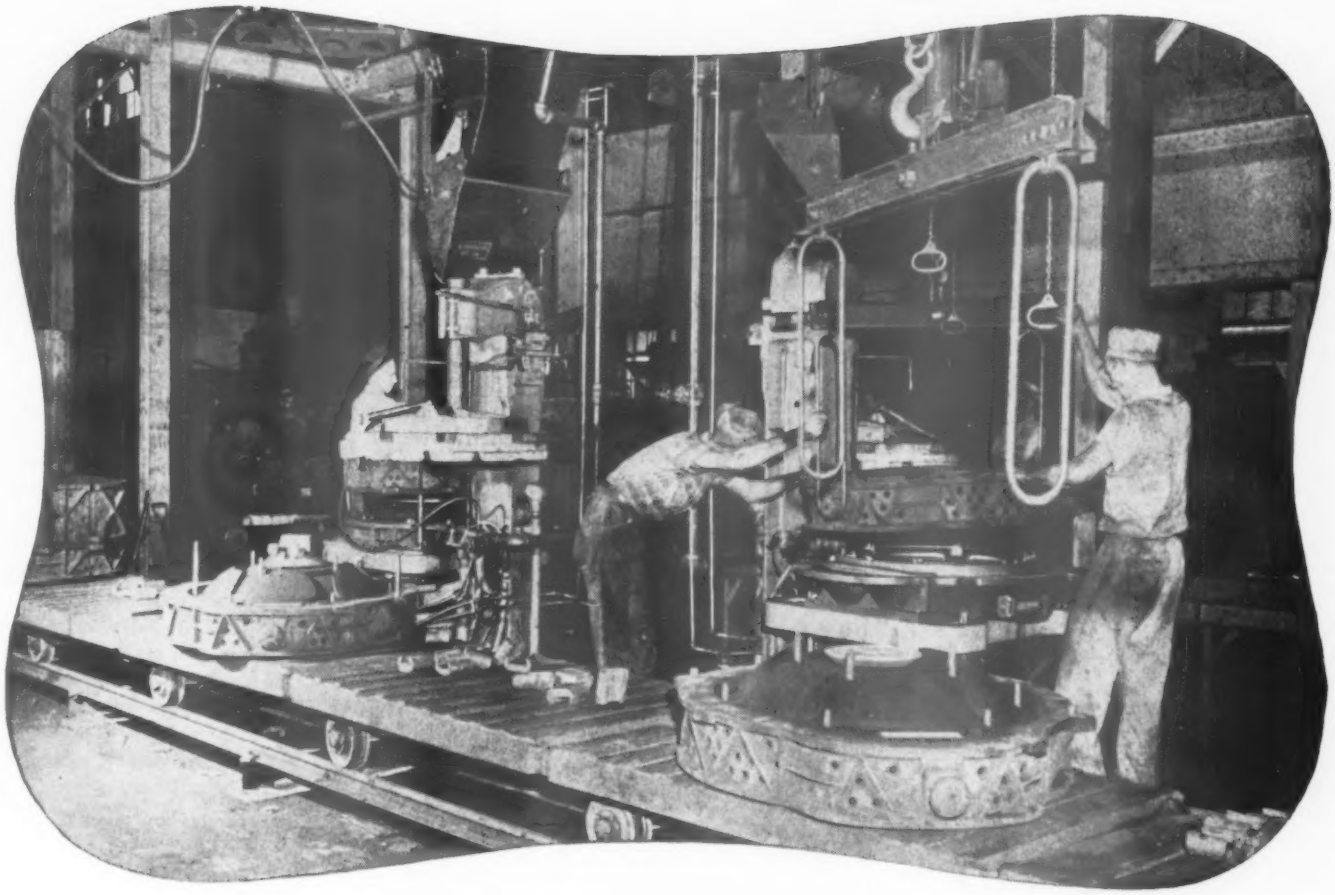
No Evidence of Inclusions

These experiments indicate that the use of lump magnesite does not introduce large inclusions into the melt because the decomposition of the magnesite occurs with little change in physical form, and the resulting magnesia is retained in the perforated metal container. Microscopic examination (at x100) of the sections used for grain size evaluation showed no evidence of magnesia inclusions.

Melts 11 to 15 were made with new ingot metal, No. 16 was a remelt of coarse grain metal, whereas mixed stock of both coarse and fine grain was remelted for heats Nos. 17 to 22. Satisfactory fine grain was obtained in all cases and the physical properties of the castings, as indicated by tensile tests, were equal to those of superheated metal.

2. Effect of Remelting Fine-Grained Castings—Fine-grained magnesium alloys do not always retain a fine structure after remelting. Mahoney, Tarr, and LeGrand[8] pointed out that the need for further grain size control upon remelting was not as great with metal previously treated with carbon as with superheated ingot or scrap. Eastwood, Davis and DeHaven[3] state that in their recommended procedure of passing a mixture of carbon tetrachloride and chlorine through the molten alloy, the tendency of the original melt to form fine grains is retained when the castings are remelted. Furthermore, they report that if an alloy is made from 25 per cent or more of previously treated metal, the castings will have a fine grain.

(*Continued on page* 238)



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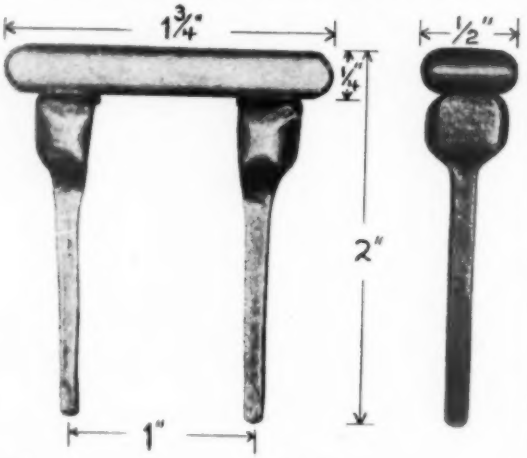

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A 5140-3/3

(Continued from page 236)

A few experiments were included to ascertain the degree to which fine-grain characteristics were retained upon remelting. In melt 23 the charge consisted of metal from melt 3 which possessed an average grain size of 0.005-in., obtained by superheating. When the metal was melted, heated to 760° C, and poured without any special treatment, the resulting grain size in the test casting was about 0.040-in., indicating complete loss of any tendency toward fine grain. Melt No. 24 was a similar remelt of metal from melt No. 10, which had been treated with carbon monoxide and which had a grain size of 0.005-in. After remelting and recasting, a grain size of 0.025-in. was obtained. The fine-grained castings from melt No. 22, which had been treated with magnesite, were remelted in melt No. 25. Castings from this melt had an extremely coarse grain (0.070-in.) Thus, in each instance the tendency towards fine grain was lost upon remelting, regardless of the method by which fine grains were produced in the original melt.

Discussion of Results — The results verify previous reports on the effectiveness of using gaseous carbon compounds for the control of grain size in magnesium alloy castings. However, treatment with graphite, whether granular or powdered, did not produce the desired fine grain in test castings. The poor showing of this method was undoubtedly due to the difficulty of obtaining a satisfactory contact between the graphite and the molten alloy. The vigorous stirring required during the carbon addition favors oxidation of the metal, and flux additions to control the oxidation appear to limit the action of the carbon. When gaseous carbon compounds are bubbled through molten metal, it is thoroughly stirred, and the reducing action of the magnesium apparently produces carbon in a form that can be readily absorbed by the alloy.

The treatment with lump magnesite eliminates the need for the equipment required to bubble gas through a melt and gives the same action and effect as when a gassing treatment is used. The magnesite is inexpensive, can be stored conveniently, and is simple to use. These advantages suggest applications of the method particularly in foundries that operate on a small scale or do not work continuously with magnesium, and where it is desired to obtain fine-grain castings without resorting to superheating or to more elaborate equipment for grain size control.

The tensile properties of castings produced by the various treatments for grain size control, as shown in the table, de-

(Concluded on page 240)

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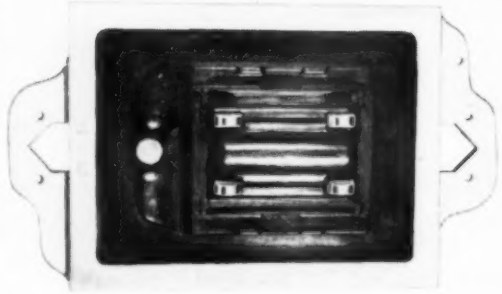

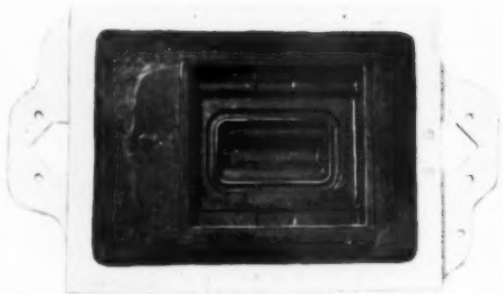

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(*Concluded from page* 238)

monstrate the advantage of fine grain, however it is obtained. The highest ultimate tensile strengths were obtained from castings having a grain size of the order of 0.005-in.

The results obtained in remelting fine-grained castings produced from metal that had been superheated, treated with carbon monoxide or with magnesite, indicate that with the techniques used in this investigation, the fine-grain characteristics of a magnesium casting are lost when the metal is remelted. The difference between these results for carbon monoxide or magnesite treatments and for those reported elsewhere for carbon tetrachloride-chlorine treated alloys is difficult to explain, in view of the fact that the control of grain size in each case has been attributed to the effect of carbon.

Acknowledgments—The authors gratefully acknowledge the assistance of R. H. Harwell and W. P. Saunders in the experimental work of this investigation.

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Book Review

Let's Be Human, by John L. Beckley, 122 pages, 5 x 8 in., published by Duell, Sloan & Pearce Inc., New York.

Mr. Beckley, a specialist in management-labor relations for a leading public relations firm, summarizes the science of handling people in seven simple points and presents them with a series of dramatic, direct cartoons carrying one or two-line captions. R. Roberts Baldwin was the illustrator and his cartoons are entertaining and to the point.

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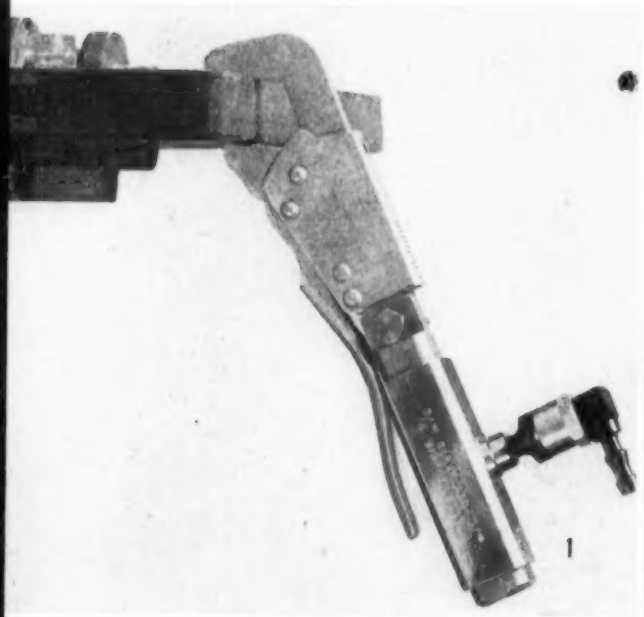
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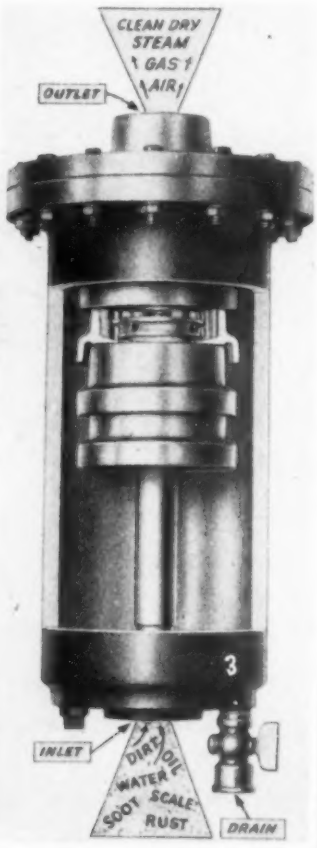

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(2)—Line Marker: Newaygo Engineering Co., State Rd., Newago, Mich.—Line marker is designed to paint a 2½ in. wide line accurately and rapidly and to locate a line within 1½ in. of walls, cases, machines, etc. Painting liquid is picked up from a reservoir in front of the paint tank by an idler wheel which spreads it on the marking wheel—the amount of paint deposited being governed by a thumb nut. Paint applicator wheel rolls the paint on the surface to be marked. The marker can be operated indoors or outdoors, and any kind of paint may be used.

(3)—Air Separator: Chicago Mfg. & Distributing Co., 1928 West 46th St., Chicago 9—Air separator for core blowing machines and other foundry-operated pneumatic machinery has no moving parts, screens or filters, and is said to require no adjustments or regulations. Entirely mechanical in operation, the new separator has a maximum rated capacity of 250 cfm and is 8 in. diam, 15 in. high, with a 1½-in. standard pipe connection. Noncorrosive metals are used throughout in its construction. Company also manufactures three other models for lower rated operating capacities.

(4)—Mixing Bowls: Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11—Synthetic rubber mixing bowls for gypsum cements and plasters are said to be practically indestructible in the service for which they are intended. They will not chip, break or corrode and are not affected by water. They are light in weight and may be bent into any desired shape to facilitate pouring. Flexing them breaks loose all set cement or plaster. They are available in 5-qt, 1½-qt, 1¼-pt, 3/4-pt and 4-oz capacities.

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(*Continued on page* 244)

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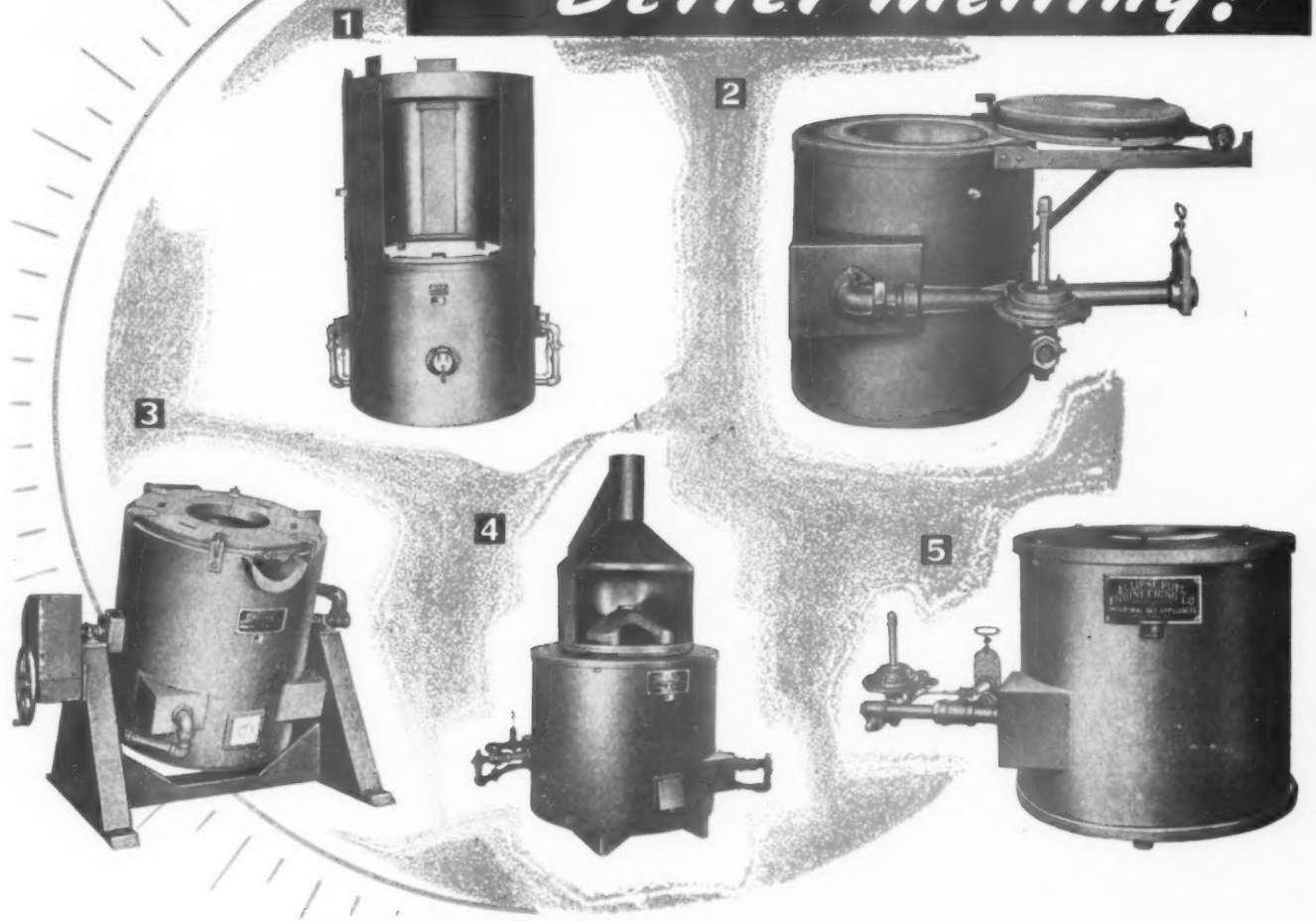

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(*Continued from page 242*)

base of the air gage. The needle is inserted in the air hose, usually with the hose bent, near the tool to obtain a reading. When not in use the needle is protected by a sleeve which has a slot in the end to aid in removing the needle. A leather carrying case is supplied with the unit.

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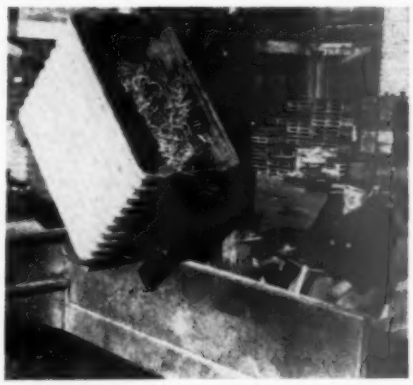

ed by hydraulic motor and gear reduction, the rotating mechanism is adaptable to fixed or adjustable forks, scoop and other special attachments.

Pyrometer Controller: Illinois Testing Laboratories Inc., 420 North La Salle St., Chicago 10—Electronic pyrometer controller for heat control of furnaces, melting pots, kilns—any heating device using electricity, gas or oil—is suitable for laboratory or production operations. Pyrometer movement is double-pivoted on jeweled bearings; 6-in. mirrored scale is easy to read; case is dust-tight and weatherproof.

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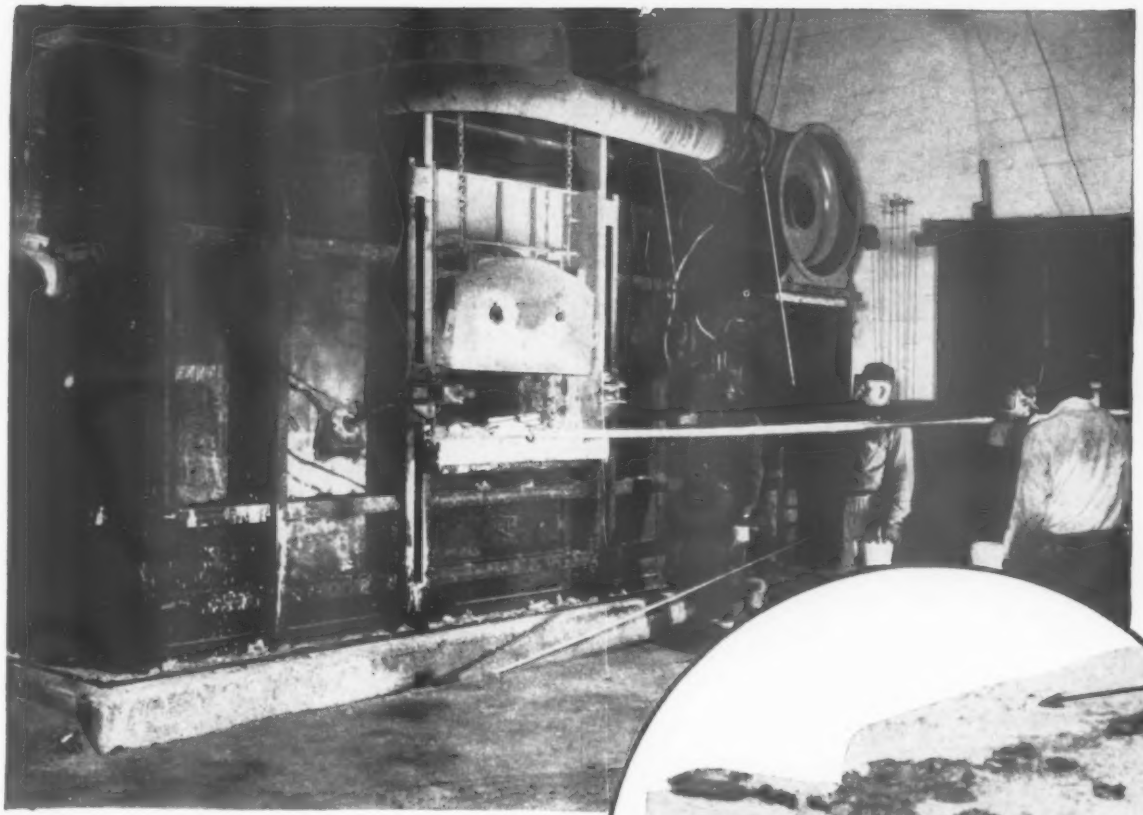
(*Continued on page 246*)



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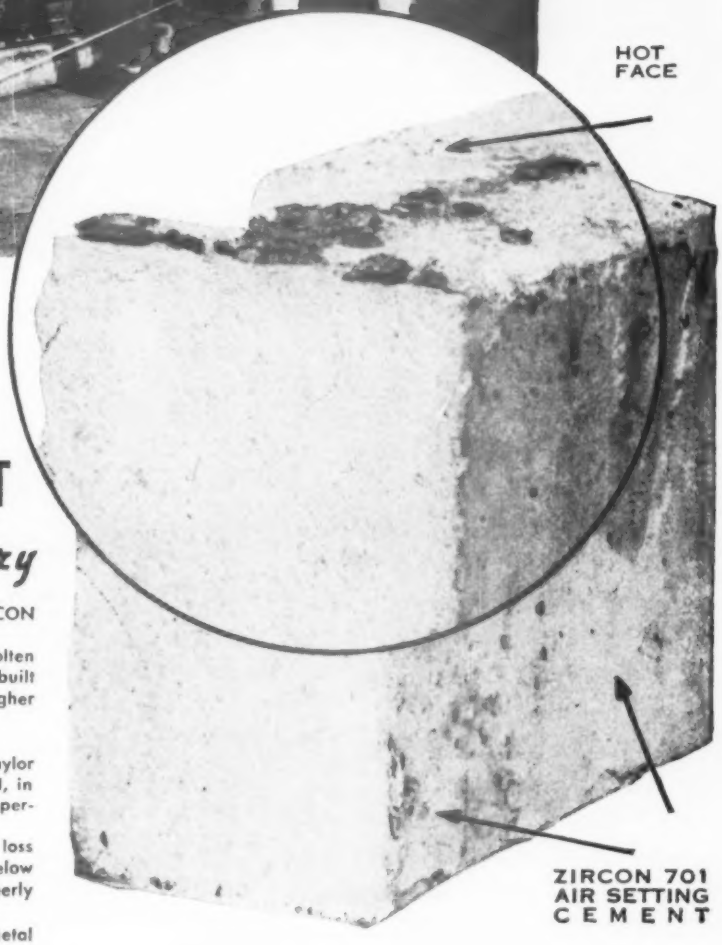

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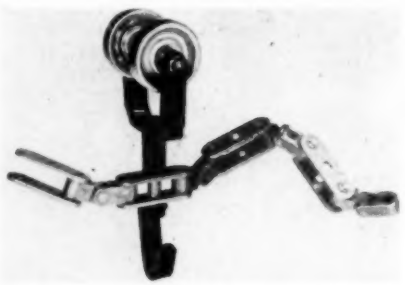

degrees to the reverse of the direction of travel on either side. It is adaptable for conveyors where small radius curves are desirable and sharp bends on different planes follow each other. It is also suitable for degreasing operations and oven work.

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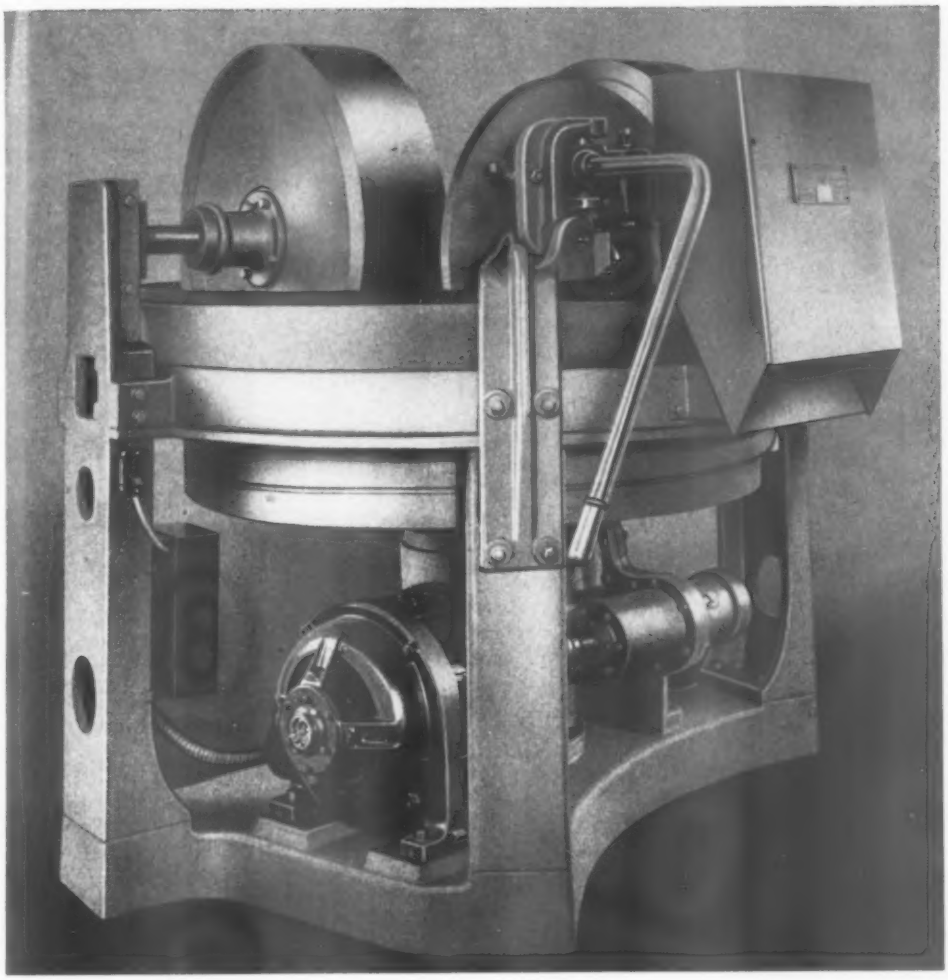
Hammer: Schmidgall Products, 307-11 Cass St., Peoria 2, Ill.—Hammer has replaceable tips made of aluminum alloy which is claimed to be tough enough for use in foundries and machine shops, yet soft enough so as not to mar delicate surfaces encountered in

(*Continued on page* 248)



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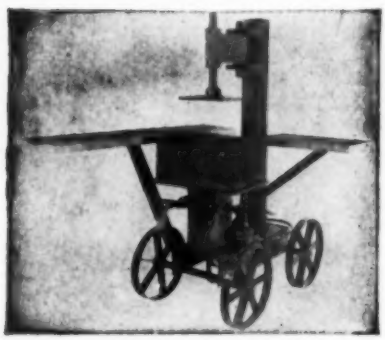

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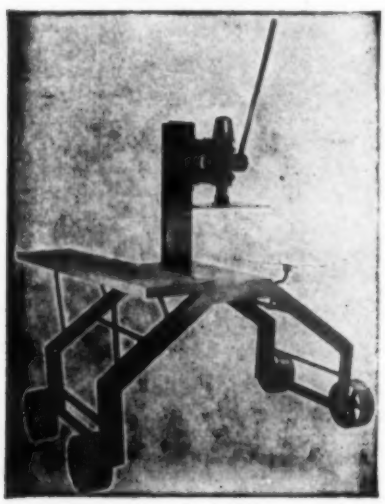

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(*Continued from page* 246)

the toolroom on dies, etc. Handle is made of hickory and fits into an oval hole in hammer head. Hammer comes in two sizes—8 and 32 oz with replaceable or nonreplaceable tips.

Transformers: Lindberg Engineering Co., Transformer Division, 2453 West Hubbard St., Chicago 12—Power and lighting transformers are available in sizes from 1 kva to 100 kva. Those rated from 1 to 15 kva are totally enclosed for outdoor and indoor use. Transformers of standard rating are made to operate at rated frequency and on any of the rated voltages up to 600 v.

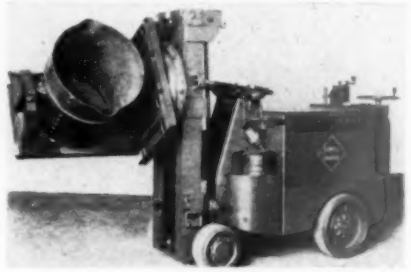
Goggle: American Optical Co., Southbridge, Mass.—Rubber frame safety goggle is designed for work in hot and humid atmospheres where chemical and dust hazards exist. Nosepiece has inhalation and exhalation valve to prevent

fogging and steaming of the goggle's large replaceable acetate single lens. Goggle protects against chemical splashes, spray and impact of foreign particles and exposures to fine dust concentrations.

Sandblasting Machine: Bay Cities Sandblasting Co., 4356 Clement St., Oakland, Calif.—Simplicity of operation is a feature of this sandblasting machine. Mixing chamber is made of bronze and stainless steel to resist corrosion. Machine delivers a continuous flow of sand, and the mixture may be made rich or lean by a slight pressure of the finger tips on the control valve handle. Sand hopper, which weighs 250 lb, holds 600 lb of sand.

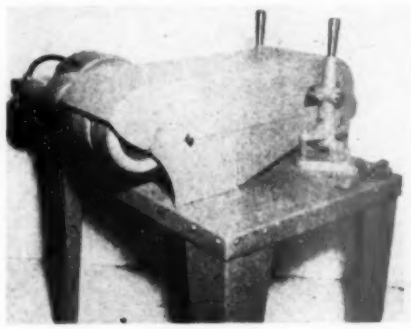
Welding Fluxes: Welding Equipment & Supply Co., 223 Leib St., Detroit 7—Welding and brazing fluxes are said not to cast off objectionable fumes, gases, red flame or smoke and not to deteriorate or solidify under any conditions. Fluxes are available for welding cast iron; for brazing iron, steel and brass castings; for brazing gray iron and malleable castings; and for brazing brass, bronze and copper.

Ladle Truck: Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland—Standard 4000-lb capacity fork lift truck has rotating head which may be used to pick up a ladle mounted on a base equipped with built-in sleeve pallets



which are engaged by forks bolted to the rotating head. Ladle is held firmly in place for transporting, raising, tilting and pouring molten metal. The driver controls all movements of the truck and rotating mechanism from his position at the rear of the machine. Rotating head is detachable, and the fork itself can be attached directly to the truck's elevating mechanism to provide the features of a standard fork truck.

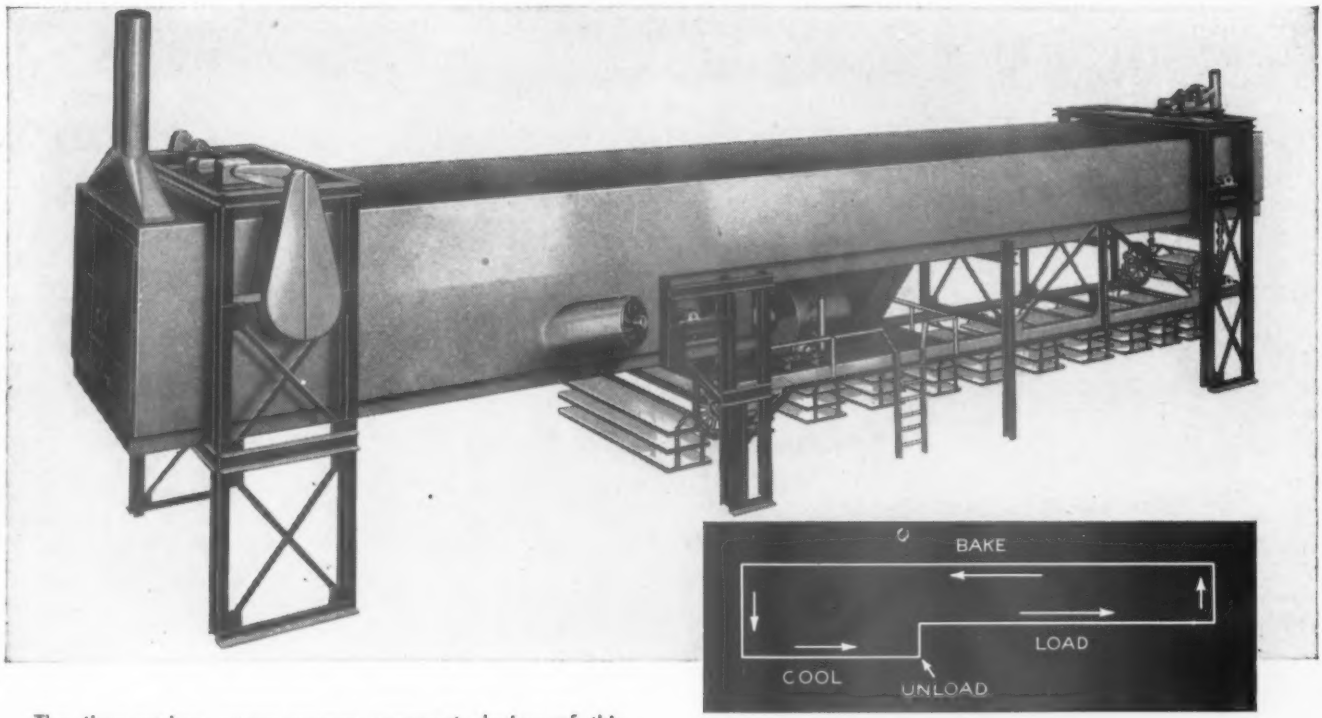
Belt Grinder: Porter-Cable Machine Co., 1714 North Salina St., Syracuse 8, N. Y.—Double belt bench grinder may be fitted with a coarse abrasive belt for rough grinding and a fine grit belt for finishing. Belts are 2½ in. wide and 60 in. in circumference and are said to be satisfactory for working all types of metals. They are mounted on two



7-in. diam by 2½ in. wide resilient contact rolls located side by side a few inches apart. Equipped with a 1-hp motor the grinder provides an abrasive belt cutting speed of 5200 sfpm.

Safety Valve: Manning, Maxwell & Moore Inc., 11 Elias St., Bridgeport 2, Conn.—New safety valve for air compressors uses a nylon disk working against a bronze seat. Nylon is said to be the only material found which

(*Continued on page* 250)



The time-saving, space-saving, compact design of this new Horizontal Core Oven is characteristic of Young Brothers' Engineering. Into it went the skill and confidence of many years of experience . . . also a thorough knowledge of the job to be done and the production problems involved.

This new core oven can be installed in practically any building without making any major structural changes.

The coremakers are located right next to the oven so that they can load the cores directly on the moving racks thus eliminating the necessity of transporting them on hand trucks or a conveyor from the core room. The location of the coremakers, at the oven, also saves core room space.

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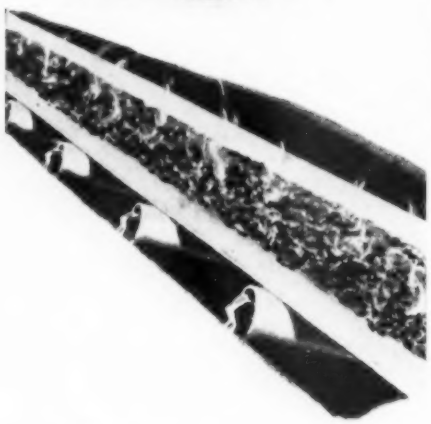

Foundries have been using Sahara Beltings for over 25 years because they are unexcelled for conveying and elevating hot materials.

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Imperial Belting Co.

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Engineered Belting—

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(*Continued from page* 248)

possesses all the essential characteristics of wear resistance, hardness and flexibility. Valve body is made of brass and is suitable for any set pressure up to and including 250 psi and is standard with ⅛, ¼, ⅜ or ½ in. NPT male inlet connection.

Pallets: Palmer-Shile Co., Dept. K, 16033 Fullerton Ave., Detroit 27—Corrugated rolled steel pallets of welded construction with nesting ring are designed for use with power or hand trucks.

Standard pallets are of various types and sizes or will be built to the customer's specifications. Pallets have beveled edges to allow hand truck wheels to ride over easily, and a center channel support and air-dry enamel finish. Pallets can be furnished with nesting ring permanently welded in place if specified.

Portable Sanders: Bradford Machine Tool Co., 657 Evans St., Cincinnati 4—Portable disk sanders and polishers have a baffled air intake in the rear handle which conveys cool air over the motor. Air, passing through the handle, also helps to keep it cool. A 7-in. sander, 9-in. sander and 7-in. polisher are available. Standard equipment includes three-conductor cable and plug, detachable side handle, backing pad, three disks for sander and lamb's wool bonnet for polisher. Standard motor is 110 v ac-dc although a 220 v ac-dc motor also is available.

Clamp: Knu-Vise Inc., 2200 Eighth St., Detroit 16—Base of new clamp has a swivel arrangement that permits angular clamping within 180 degrees. This feature is said to eliminate the necessity for shimming the base. Work is automatically locked by the characteristic toggle action of the clamp. A man's normal hand operation can exert a pressure of 1350 lb at the extreme end of the bar. Clamp is 16¼ in. high, 9⅞ in. long and weighs 7¼ lb.

Strainer: A. W. Cash Valve Mfg. Corp., Wabash and Morgan Sts., Decatur 60, Ill.—New "Y" type strainer is available in pipe sizes from ⅛ through 2 in. and is made of cadmium plated cast iron or all bronze. Strainers are built around 250-lb standards for cast iron and 400-lb for bronze.

Arc Welders: General Electric Co., 1 River Rd., Schenectady 5, N. Y.—Single operator dc arc welding machines operate at 3500 rpm and are available in 200, 300 and 400 amp NEMA ratings. Single dial, dual control is said to make possible presetting the correct current for a given job without making adjustments after the arc is struck. Standard assembly includes a stationary welding generator, driving motor, control cabinet and panel, and a motor starter assembled into a compact unit. Company's new ac inert-arc welder is designed for welding aluminum, magnesium and beryllium copper in an atmosphere of argon gas without the use of flux but also may be used for other metals and alloys. Entire assembly is built into a compact unit enclosed in a drip-proof case.

Spiral Cutters: Cadillac Cutter Co., 613 Eastern Ave. S. E., Grand Rapids 7, Mich.—Tapered spiral cutters are particularly suited to machining dies, molds and patterns where draft is required. Design features of these tools include a straight shank with flats for insertion in set screw holders, uniform hook rake, R. H. cut, R. H. spiral and three flutes to minimize chatter and provide added strength. Size range from ½ to 7 degree taper per side, ½ to 3½-in.

flutes and small end diameters from 3/32 to 1/2-in. Radius or ball ends can be furnished to specifications.

Wheel Dressing: Diamond-Detroit Inc., 8-270 General Motors Bldg., Detroit—New device said to be adapted to most types of grinders that use diamond dressing tools is designed to hold the diamond tool against the wheel being dressed in such a way as to produce a uniform rotation of the diamond and cause a new face to be presented to the wheel with each pass. Tool is available in three models: One automatically rotates diamond tool by a cog wheel and

(*Concluded on page* 252)

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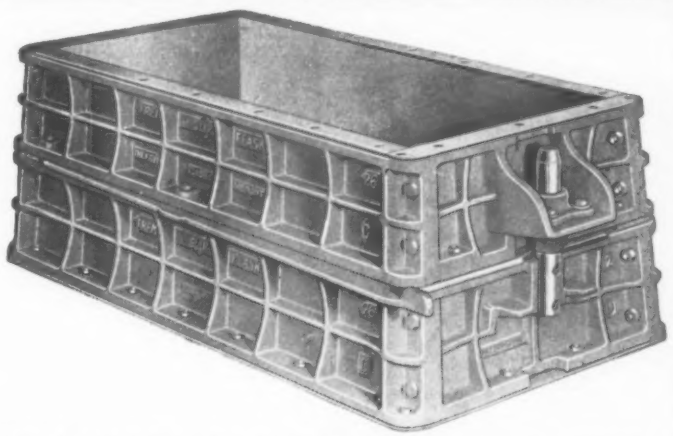

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Soapstones and Talcs
Truline Binder

The Smith Facing & Supply Co.
1857 Carter Rd., Cleveland, Ohio

(*Concluded from page 250*)

trip; another provides for hand indexing in front, and the third has indexing disc in rear.

Tote Box: United Steel Fabricators Inc., 1855 Turner Ave. N. W., Grand Rapids 4, Mich.—Tote box has carrying capacity of 8000 lb and is constructed with all-welded angle iron frame and ¼-in., 5-lb mesh siding and bottom. Bottom of ¼-in. corrugated steel is optional. Mesh siding allows air to circulate through box, providing better ventilation and parts cooling. When stacked for storage, boxes need not be unstacked or moved to identify contents. A 4-in. underclearance is provided for fork lift trucks, and guides on upper corners permit straight, secure stacking.

Lift Truck: Hyster Co., 2902 N. E. Clackamas St., Portland 8, Oreg.—Three wheeled fork lift truck has capacity of 4000 lb and travels on pneumatic tires. Gasoline powered, the truck has a speed of 12 mph forward or reverse. It is 42 in. wide, has a turning radius of 77 in. and a standard lift of 9 ft to the underside of the load with lifts of 6 to 12 ft available. Lifting and tilting mechanism is hydraulically operated. A variety of scoops, and special attachments are made for specialized applications of the truck.

Air Compressors: Davey Compressor Co., North Water St., Kent, O.—New line of two-stage, air-cooled industrial air compressors of 60, 105, 160, 210 and 315 cfm capacities are equipped with a new balanced crankshaft which is reputed to reduce compressor vibration to a minimum. Compressors are available in four types. Base compressors, stationary units with base ready for installation of customer's electrical equipment, departmental compressors powered by ac motors and departmental compressors with dc motors.

Die Casting: DCMT Sales Corp., 315 Broadway, New York 7—New 3-oz cold chamber pressure die casting machine for aluminum alloys utilizes single cavity molds. It injects metal under high pressure with a pneumatically operated metal injection plunger.

Dust Collector: Torit Mfg. Co., Walnut & Exchange St., St. Paul 2—Dust collector is designed for use with a 3-hp, 3450-rpm motor and handles air at 1500 cfm at a velocity of approximately 6000 fpm and static pressure of 3¾ in. with one 7-in. inlet. Unit is equipped with 30 filters, each 24 x 30 in., and has a total filter area of 300 sq ft. Seven-in. inlet holes are fixed on each side and in the back. Only one may be used at a time. Air may be exhausted at top or through the back.

EFFECT OF CHILLS ON SOLIDIFICATION OF GUN METAL

(*Continued from page 73*)

crucible was held as close as possible to the mold and the stream of molten metal entered the mold parallel to the lengthwise direction, i.e., poured against the 2-in. end of the molds. The castings were molded vertically in sheet metal or wooden flasks 15-in. square and 12-in. in height, mounted in trunnions to permit inverting the mold for bleeding. Top edge of the casting was nearly even with the top of the mold. No riser was put on the casting and no pouring basin or runners were used. It was necessary that the mold be filled as rapidly as possible in order to obtain uniform distribution of temperature. After the mold had been filled, powdered gypsum was put on the surface of the metal to prevent excessive loss of heat to the atmosphere.

Bleeding Experiments—When the desired time had elapsed for solidification on the chill, the mold was inverted, as shown in Fig. 1. The time was measured by stop watch reading in tenths of seconds. The beginning of time measurement was taken at that instant when the mold was half full of molten metal. The end was taken when the first motion of the mold occurred in the overturning operation. The metal was poured from the casting with as little disturbance as possible so as not to damage the solidified layer on the chill. The mold was never completely inverted in the bleeding experiments, rotation being about 150° for best efflux of molten metal with least disturbance of the newly solidified skin.

Since cast bronze has very low hot strength, considerable difficulty was encountered in obtaining the rate of solidification in the 2 x 6 x 6 in. sand mold with no chills. Invariably the solidified shell fell away from the sand walls when the mold was inverted. In order to cause the least amount of disturbance in the melt, bottom pouring was then attempted. A valve consisting of a gypsum stopper was situated in the bottom of the mold. Although the stopper was withdrawn from the outside of the mold, difficulty was still encountered when the skin, deforming under its own weight, fell away from the mold walls. In order to obtain adherence of the bronze layer to the walls of the mold, it was finally necessary to place small nails in the

(*Continued on page 254*)

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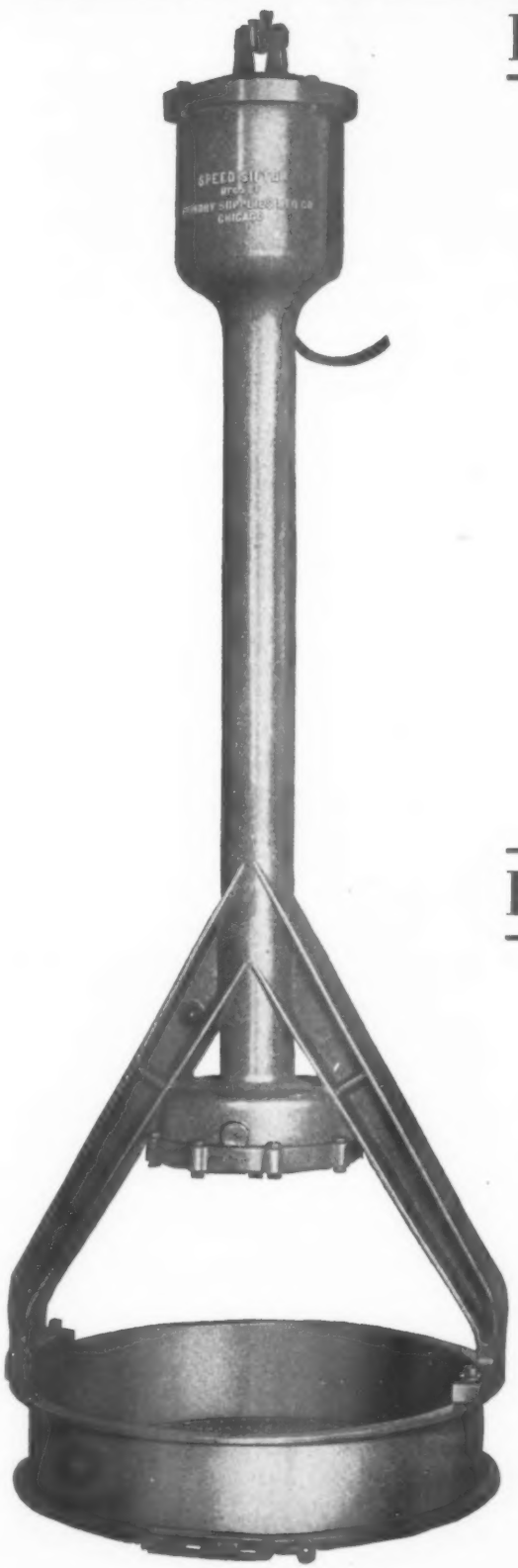

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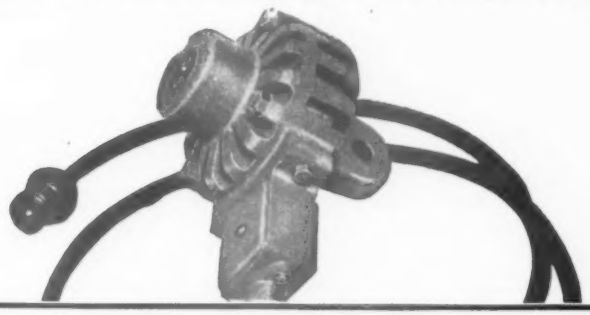

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(*Continued from page* 252)

mold with heads protruding from the wall for a distance of about 1/8-in. Eight nails evenly spaced were placed in each 6 x 6 in. face and one nail in the middle of each 2 x 6 in. end of the mold. The nails were 1-1/4 in. long, 1/16 in. diameter with heads 3/16-in. diameter. As a result of the added support from the nails, the layer of bronze held to the sand surface when the mold was inverted for bleeding.

Preparation of Chills—The plates used as chills consisted of SAE 1020 cold-rolled steel, carbon and graphite. The plates were of the following thicknesses: Steel 1/4, 1/2, 3/4, 1, 1-1/8, 1-1/2 in.; carbon 1/4 and 1-1/8 in.; graphite 1/4, 1/2 and 1-1/8 in.

Steel chills over 1-in. thick could be re-used many times, but thin steel chills often proved unsuitable for further use after the first experiment. The steel chills were sand blasted to clean off the oxide film acquired during exposure to high temperature and the rust resulting from dampness in storage. Nails welded to the back of the heavier steel chills extended into the sand and held the chills in place. The carbon and graphite chills, irrespective of thickness, were continued in operation until rendered unfit through abrasion or breakage. A thin layer of glue was placed on the back of the graphite and carbon chills to keep them in position when the bronze was poured out of the mold. The carbon and graphite chills were dried out before being placed in the mold the first time. Light brushing to remove dirt was the only other requirement in their preparation.

Measurements of Thickness of Solidified Layers—Measurement of the thickness of the solidified layers of bronze of the various chills was made with outside calipers which could be read to about 1/64-in. Measurements were made at the central region of the solidified layer after it had been sawed in half. Thickness of the solidified layer was taken as the average of nine caliper measurements. Measurements were plotted against time of formation of the solidified layer in Figs. 2 and 3.

Measurement of "Time to End of Bleeding" — The foregoing experiments, while being of interest in comparing the chilling action of various materials, show little regarding the relationship of chill thickness to thickness of section. In order to obtain information on this aspect of the problem with steel chills, the "time to end of bleeding" was next measured with 1/2, 1 and 2-in. sections of the casting. Similar precautions were taken in this part of the investigation as in the bleeding experiments. The casting had to be held in the mold somewhat more securely to prevent it from falling out in the bleeding. The surface of the casting was more heavily insulated with gypsum to prevent incipient freezing at this critical region. The "time to end of bleeding" was determined when only a small amount of partially liquid metal at the center of the surface broke away when the casting was inverted.

Generally, five identical castings were poured as quickly as possible at either 1100°C ± 5° or 1150°C ± 5° and the gypsum put on the surface. At some time believed close to the end point of solidification the molds were inverted in succession at 5-second intervals. In these experiments rotation through 150° was necessary because the last metal to remain molten tended to be held by capillary action in the interdendritic regions of the alloy.

Discussion of Results—The 2 x 6 x 6 in. casting proved very satisfactory in the bleeding experiments. Dimensions of the casting were chosen with respect to (1) the maximum thickness generally found in bronze castings, (2) the dimensions necessary to prevent too great an effect from heat loss at the ends of the mold, and (3) the volume of metal which might be easily cast or bled. The mold proved most satisfactory when bled by pouring from the top. Pouring from the bottom would have been another possibility were it not for the longer time taken by this operation and the metal penetrating into the crack around the plug and freezing in this position.

The difficulties encountered in measuring progressive solidification of bronze against a sand surface are believed but partially overcome. Use of the nails to restrain the weak layer of bronze did not introduce any appreciable error because the mass of the nails was small compared to the mass of the thinnest layer. The chief source of error is believed to be the removal of some weak dendrites by the scouring action of outflowing bronze. This may be reflected in the contour of the curve in Fig. 2, representing skin formation on sand. It must be remembered, however, that sand presents an entirely different mechanism of heat dissipation in the early stages of freezing than the chill materials used as inserts. Some heat is absorbed by vaporization of the moisture of the sand, and both water vapor and mold gases conduct heat away rapidly by convection as well as by conduction.

Solidification of bronze may be regarded as either a two or three stage process depending on whether the metal is freezing in a sand mold or against a chill placed in a sand mold. The first stage is the same in both instances. The metal loses heat to the mold material but not sufficiently for a solid layer to form with any degree of permanence on the inside of the mold. As shown in Fig. 2 no solidification of bronze oc-

(*Concluded on page* 256)

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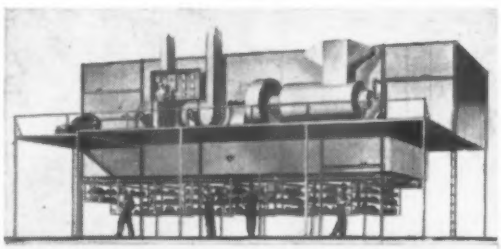

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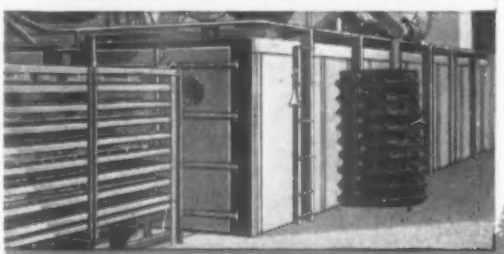

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(*Concluded from page* 254)

curred in the sand mold for 97 seconds in the first stage of solidification. By extrapolation of the curves of solidification on steel chills the corresponding period of time is found to be under approximately 4 seconds.

The second stage of solidification is characterized by rapid formation of a solidified layer inside the mold, but the rate of formation steadily decreases at the close of this stage. Apparently, this phenomena is most evident when bronze is freezing on the surface of a steel chill. The decrease in rate of solidification is caused primarily by the thermal capacity of the chill being reached.

Heat Absorbed By The Chill

The third stage of solidification is reached when the rate of formation of solidified metal becomes essentially constant. Heat absorbed by the chill is limited by the material having the least thermal conductivity and heat capacity. Although the physical constants of various materials may change the rate of solidification appreciably, the same three stages of solidification are believed to be present. The solidification of bronze on sand follows the same characteristics observed in the solidification of bronze in the steel chills.

It is apparent in Fig. 2 that the most important difference in steel chills is the heat capacity of the chill. The thin steel chills were heated to higher temperatures than the heavy chills and tended to stick to the bronze castings. A thin wash of graphite, or, better still, cast iron chills may be used if such a difficulty is encountered in practice. Independent experiments have shown that equal thicknesses of cast iron and plain carbon steel have the same chilling effects.

The curve for the 1/4-in. steel chill was replotted in Fig. 3 in order to compare the chilling effect of steel with that of carbon and graphite. The generally parallel character of these curves indicates that after the chills became saturated with heat the process of transmission to the sand by means of conduction and radiation is very similar. Graphite, being a crystalline material, would be expected to be a better conductor than amorphous carbon as shown in this figure. Generally both carbon and graphite chills failed by breakage after a few measurements. There was no serious burning of the carbon or graphite chills with re-use and there was no change in chilling effect.

The inside surface of the solidified layer of bronze was roughened by dendrites approximately ⅛ to ¼-in. apart. The condition was somewhat worse in layers having low rates of solidification on account of the larger size of the dendrites. As a result of the roughness of the surface of the solidified layers, it was believed that the precision of measurement of ±1/20-in. was sufficient.

Results of the second part of this investigation are summarized in Fig. 4. The "time to end of bleeding" was plotted against thickness of steel chills so that an estimate of chill thickness for a variety of wall sections of bronze may be made. In general, steel chills more than one-fourth to one-half the thickness of the section of bronze have little added effect. The results in Fig. 4 are in qualitative agreement with the results in Fig. 2 in this respect. It will be noted that steel chills more than 1 in. thick produce little increase in skin formation in the 2-in. thick casting.

If an attempt is to be made to control solidification by differential chilling, chills less than one-half the thickness of the section may often be necessary. On the other hand, if there is a flow of metal over the chill to any appreciable extent, there is then need for chills of much greater thickness. The thickness of the section, although perhaps a very obvious factor, is by no means always the determining factor in selecting the proper type of chill for a certain casting.

Conclusions—

1. On the basis of equal volume the relative chilling effect of various materials in order of decreasing effect is as follows: steel, graphite, carbon and sand.

2. As a chill material for bronze, steel (or its equivalent, cast iron) is greatly preferred to graphite and carbon on account of its relative indestructibility.

3. In a simple casting such as that used in this investigation, the thickness of the chill need not be more than one-fourth to one-half the thickness of the casting.

4. Effectiveness of a chill depends upon its heat capacity and its ability to dissipate heat.

5. After initial chilling, the cooling of a chill is dependent upon heat transfer to the mold.

Foundry Celebrates Double Anniversary

Grede Foundries Inc., Milwaukee, celebrated a double anniversary Aug. 13 at the Avalon Hotel, Waukesha, Wis. It was William J. Grede's 27th anniversary as a foundry owner—he purchased the Liberty Foundry Co., Wauwatosa, Wis., in August, 1920—and the 20th year since Mr. Grede and H. P. Kreulen took over operation of the Spring City Foundry Co., Waukesha.

Guests of honor were Henry E. Blair, former president, Spring City Foundry Co., Congressman Glenn R. Davis, principal speaker at the celebration, and veteran employees of the five Grede foundry divisions.

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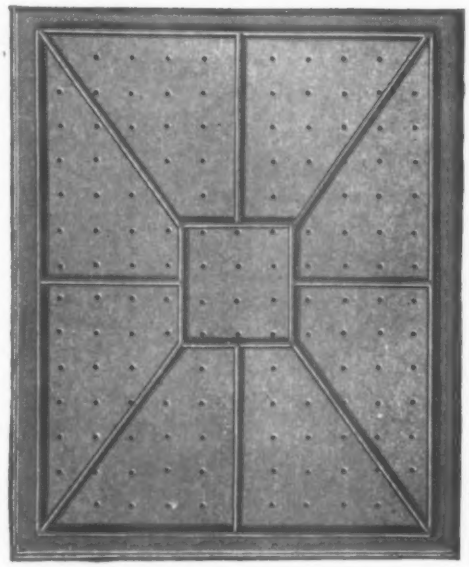
CORE PLATES



STYLE CP-3—This type reinforcing on "square" plates for loads up to 1200 lbs. Typical sizes run 40" x 50" and 36" x 60".

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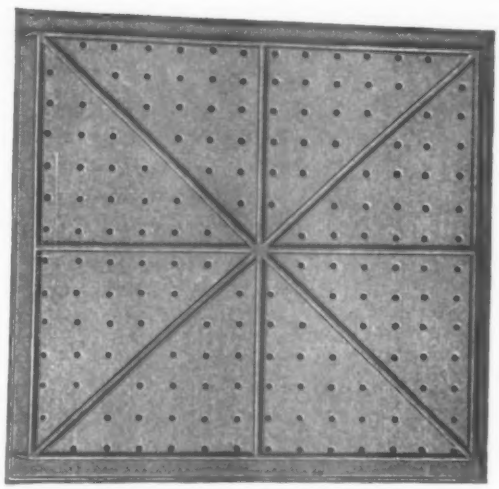
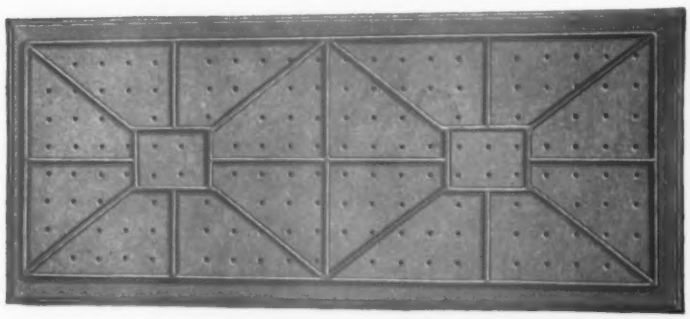


STYLE CP-1—This construction used on plates in the 30" x 30" range for core loads up to 200 lbs.



STYLE CP-2—For long and narrow cores and loads to the 1200 lb. range. Note web-bracing construction.

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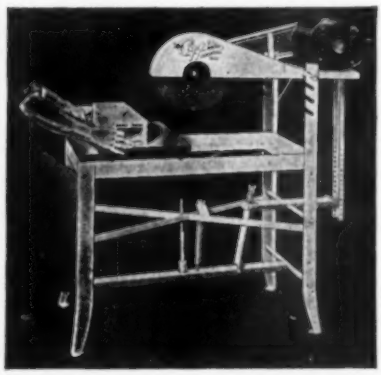

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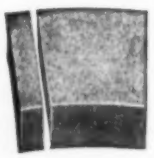

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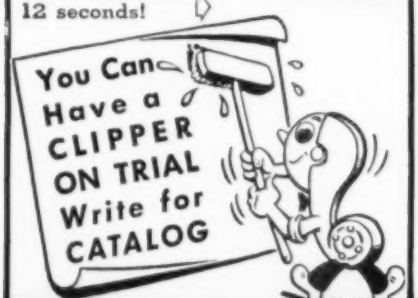

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...TRADE PUBLICATIONS...

WELDING: Victor Equipment Co., 844 Folsom St., San Francisco 7—Catalog in four colors contains descriptive literature and prices of welding and cutting equipment and gas regulators.

VENTILATOR: G. C. Breidert Co., 3129 San Fernando Rd., Los Angeles 41—Advantages gained by applying aerodynamic principles to ventilator design are described in booklet which also includes results of wind tunnel tests and of actual use on many installations.

MILLING TOOLS: Severance Tool Industries Inc., Box 850, Saginaw, Mich.—Catalog 16 contains illustrations, specifications and descriptions of the company's midget mills, deburring, tubing cutter, countersink and miscellaneous tools.

WORKING MAGNESIUM: Superior Magnesium Castings, 140 Banker St., Brooklyn 22, N. Y.—Booklet "Machining and Finishing Magnesium Castings," is divided into sections which include discussions of tools, cutting fluids, distortion, finishing and decorative finishng.

VALVES: Hanna Engineering Works, 1765 Elston Ave., Chicago 22—Bulletin gives specifications and operating data on the company's valves. The line consists of foot operated and hand operated valves for air and hydraulic lines, and speed control valves for use with air and hydraulic cylinders.

MATERIAL HANDLING: Lyon-Raymond Corp., 3599 Madison Ave., Greene, N. Y.—Bulletin 201 describes and illustrates general line of material handling equipment including hydraulically-operated lift trucks, pallet trucks, elevating tables, high lift trucks and sheet feeding equipment.

DUST CONTROL: American Wheelabrator & Equipment Corp., 505 South Byrkit St., Mishawaka 2, Ind.—Booklet describes the company's dust collectors and contains specifications on its three types of machines for handling air volumes from 270 sfm. up. Illustration of typical installations also are given.

SAFETY CLOTHING: Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3—Catalog 50 describes and illustrates hundreds of safety clothing and equipment items. It suggests the type of safety clothing or equipment to use to meet specific accident prevention needs.

SAFETY TOOLS: Ampco Metal Inc., 1745 South 38th St., Milwaukee 4—Catalog 118 illustrates and gives descriptions and dimensions of tools available for use in hazardous locations. The tools are recommended for use in the presence of explosive liquids, fumes, gases, or dust and are nonmagnetic, rustless and corrosion resistant.

LIFT TRUCK: Clark Tructractor, Division of Clark Equipment Co., 258 West Champion St., Battle Creek, Mich.—Booklet describes company's 1000-lb fork lift truck for handling a wide variety of lift-haul chores. Illustrations of the truck at work in several manufacturing plants are included.

CONVEYORS: Rapids-Standard Co. Inc., Dept. RWC-143, 342 Peoples National Bank Bldg., Grand Rapids 2, Mich.—Catalog C-142-4 contains descriptions, photographs and specifications of the company's line of gravity conveyors and accessories. Performance records and assembly diagrams also are included.

CONTROL INSTRUMENTS: Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4—One booklet describes an instantaneous and portable electric moisture tester for sands in floor or system type foundries. Another booklet deals with equipment available for carbon and sulphur analysis of organic and inorganic materials.

BUFFING MACHINES: Standard Electrical Tool Co., 2507 River Rd., Cincinnati 4—Catalog B10 illustrates the company's line of heavy duty and extra heavy duty buffing and polishing machines in sizes ranging from ½ to 60 hp. Variable speed buffing and polishing machines having speed settings between 1500 and 3000 rpm are described also.

METAL COATINGS: Lithgow Corp., 333 West 40th Place, Chicago 9 — Illustrated brochure describes a wide range of baked-on synthetic resin coating applications, plant and field facilities, research and actual names of users. In addition to metal container coating and lining, the material is said to have application in impregnating castings for correction of leakage and other faults.

MAGNETIC PULLEY: Eriez Mfg. Co., 2810 East 12th St., Erie, Pa.,—Bulletin 501 describes how ferrous metal contamination may be automatically removed from materials in process. Engineering data is given to aid in selection of proper units. Principles of design and operation, specifications and tables of capacities, dimensions and weights, are included.

GRINDING MACHINERY: Bridgeport Safety Emery Wheel Co., 1295 West Broad St., Bridgeport, Conn.—General catalog 147 illustrates and provides descriptive and specification data on the company's line of grinding machinery and grinding wheels including horizontal face, vertical surface, knife and floor stand grinders, buffing lathes, cut-off machines and cutlery grinders.

NICKEL WELDING: International Nickel Co. Inc., 67 Wall St., New York 5—16-page booklet on the materials required for the metal-arc, oxyacetylene and submerged melt welding of nickel and the high nickel alloys, also contains general information on the type of welding rods to use, recomended amperages for electric-arc welding, and the proper flux to select for welding and brazing.

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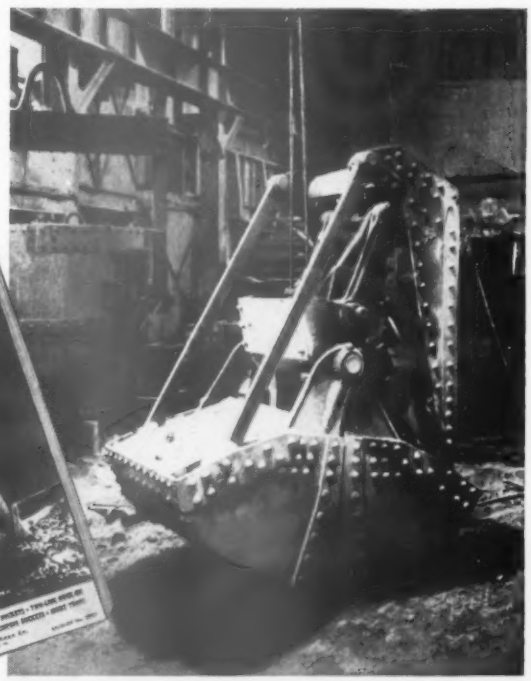

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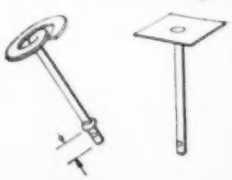

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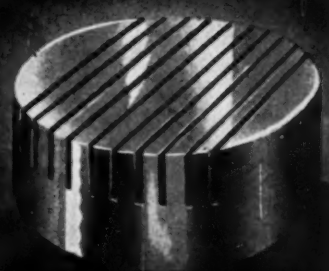

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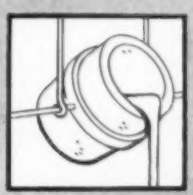

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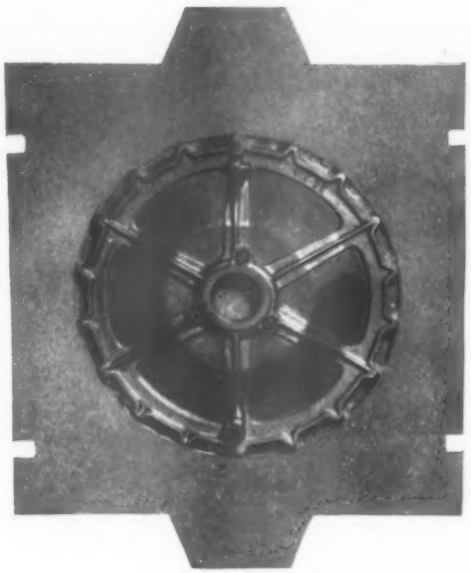

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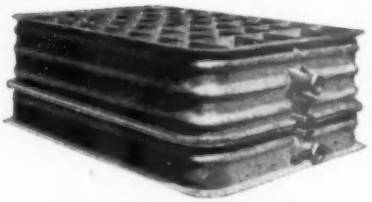

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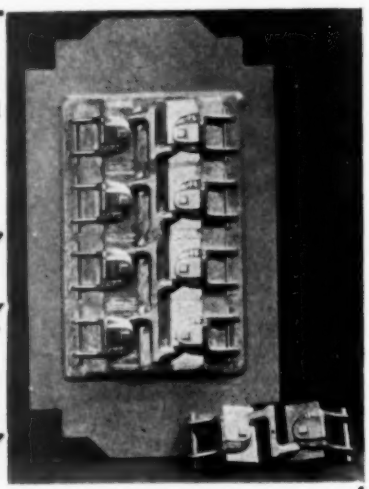

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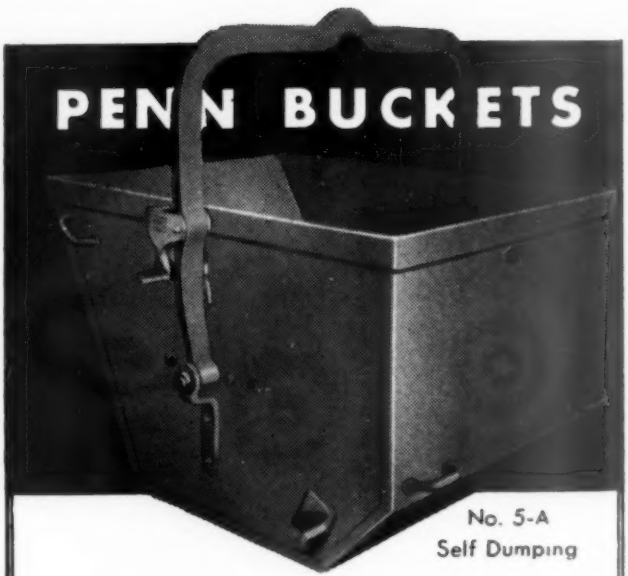

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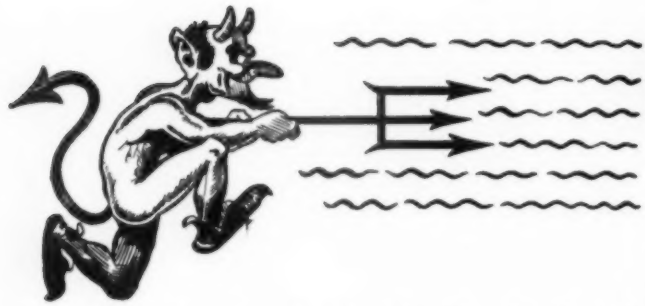

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SOFFEL'S FLUXES FOR FERROUS AND NON-FERROUS METALS

THERMOTOMIC COMPOUND is an exothermic material which can be molded and baked into any desired shapes just as sand cores are made. It produces a temperature of 3500° F. It is used as ring inserts, under the risers or feeding heads, or as facing inserts where it is desirable to maintain the fluidity of metal in the mold at those points where rapid cooling may cause piping, shrinkage, or segregation. Great savings are realized through reduced riser dimensions and cleaning costs. Yield is increased as much as 50% or more. A large steel foundry reported a saving of $1075 on 50 castings using the THERMOTOMIC material. Let us help you realize similar benefits in YOUR foundry.

SOFFEL'S CARBON-FREE LIQUIDIZER

CARBON-FREE LIQUIDIZER is an exothermic feeding head compound, which, when applied on the molten metal in heads and risers, reacts with itself exothermically producing a temperature of 3150° F or more. This heat actually raises the temperature of the feeding metal well above that of the metal in the main body of the casting, thus ensuring that the feeding heads will be the last to solidify. CARBON-FREE LIQUIDIZER also acts as a deoxidizer and adds fluidity to the metal. Tensile strength and transverse are greatly increased. When used in the ladle, in addition to increasing fluidity, it also purifies and refines the metal. Carbon-Free Liquidizer should ALWAYS be used to promote better feeding of castings, and also in conjunction with Thermotomic compound. Neither Thermotomic Compound nor Carbon-Free Liquidizer will contaminate any metal in any way.

SOFFEL'S BB-2 BRASS FLUX

BB-2 Brass Flux adds fluidity to brass and bronze, and imparts greater tensile strength to the metal. It will remove cuprous and cupric oxides from any brass or bronze. BB-2 BRASS FLUX is recommended for use in open flame or crucible furnace for melting of red brass, aluminum bronze, manganese bronze, and for refining borings and turnings. BB-2 BRASS FLUX is a perfect deoxidizer and degasifier and forms a chemical union with sulphur, carbon, iron, and the sulfides that may be present and occluded in the metal. It will positively remove iron from any brass or bronze except aluminum and manganese bronze. Many foundries have found metallic deoxidizers unnecessary when using SOFFEL'S BB-2 BRASS FLUX. BB-2 BRASS FLUX will keep crucibles and furnace linings clean and will save metal losses through dross skimmings; which alone will more than pay the cost of its use.

SOFFEL'S FLUX AND COATINGS FOR PERMANENT MOLD AND DIE CASTINGS

For zinc base die-casting alloys, babbitt, lead, tin, and other white metals, we strongly recommend our KLEN-ZINC FLUX. KLEN-ZINC FLUX practically eliminates dross loss of the metal. It will remove iron and sulfur, and is a powerful deoxidizer. It imparts greater fluidity to the metal and permits lower pouring temperatures. Castings will be smoother and have a better color and higher tensile strength. SOFFEL'S KLEN-ZINC FLUX contains no tin or other impurity, and will not change the chemical analysis of the metal in any way.

SOFFEL'S PERMANENT MOLD COATING for aluminum and magnesium will withstand 3200° F. Its insulating value aids in producing more uniform cooling of castings and in eliminating shrink cracks. Castings will be smoother and cleaner as they come from the mold, thus saving costs in buffing and polishing operations.

SOFFEL'S DIE MOLD COATING is unexcelled for pressure die casting of zinc-base alloys and white metals. It is compounded from highly refractory volcanic minerals and clays, and is guaranteed to produce cleaner castings, free from gas and surface oxides.

Pittsburgh Metals Purifying Corp.

Producers of Fluxes and Purifiers for All Metals And Alloys

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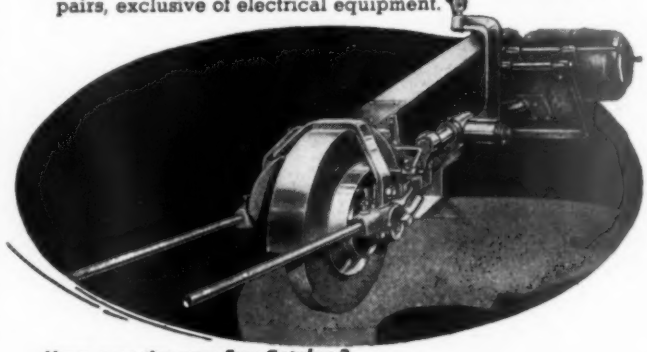

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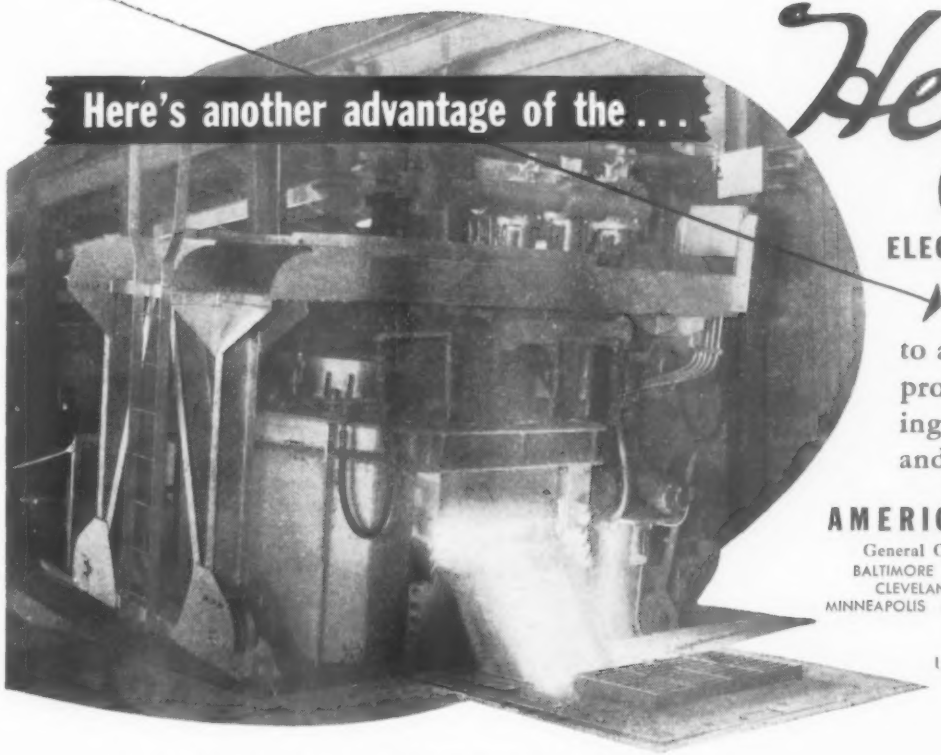

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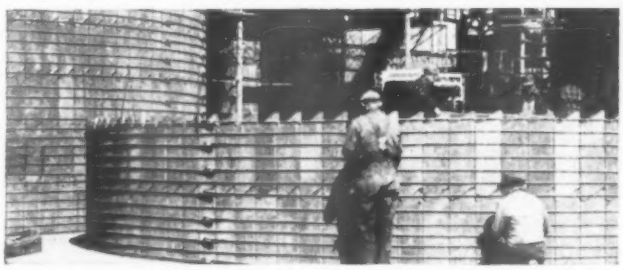
UNITED STATES STEEL



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The stave is formed under 140 tons' pressure, giving a compressive strength of at least 5000 lbs. per sq. in.

Neff & Fry bins are erected by trained crews sent anywhere. Each job is specially engineered. Diameters and heights available as required. Ask for catalog containing full information and photos of installations.

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CAMDEN, OHIO

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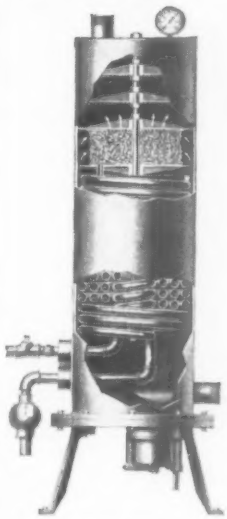

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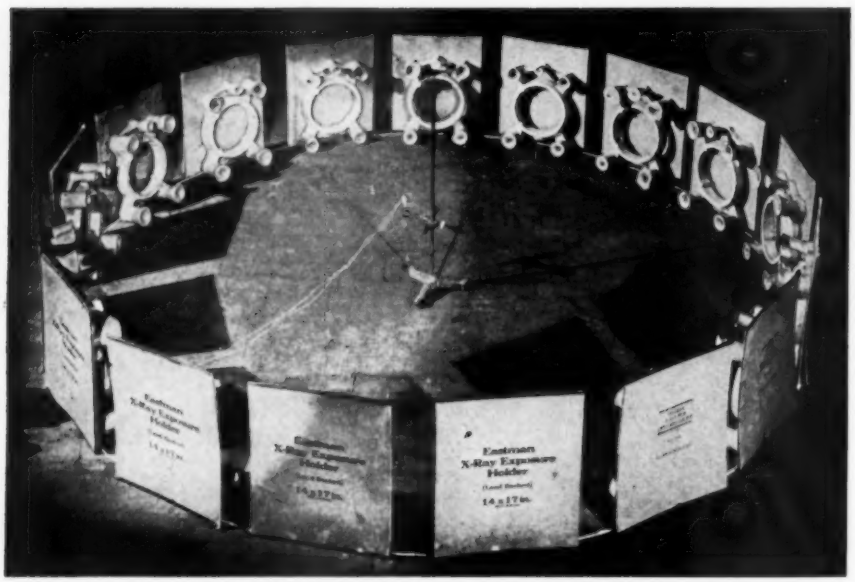

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"Directional solidification" can easily be studied by the set-up illustrated in the photograph—to indicate the best method of casting with a minimum of defects in the casting itself.

Radium has become a new foundry tool which directly effects an increase in yield. It permits accurate determination of the proper procedure in gating and risering "tough" castings. Seventeen cylindrical castings were radiographed simultaneously by Crane Co. to ascertain the most productive and economical foundry practice.

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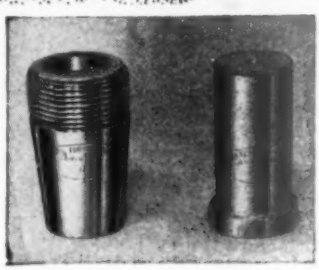
Saves AIR

Saves SHOT, GRIT SAND



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"The hardest material known to man." For this reason they outwear ordinary nozzles in use for sand blasting and metal cleaning by the blast method. Air consumption is reduced and the blast is *concentrated* because the hole in the nozzle wears very slowly. This means low cost operation.

TRY ONE AND SEE FOR YOURSELF—Made in all sizes and types: adapters furnished for all types of blast cleaning equipment.

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Have been adopted as standard by some of the largest users of Rammers throughout the Country. MADE IN FIVE SIZES. Send for Bulletin No. 300.

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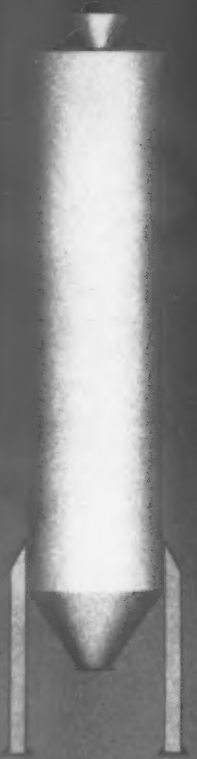

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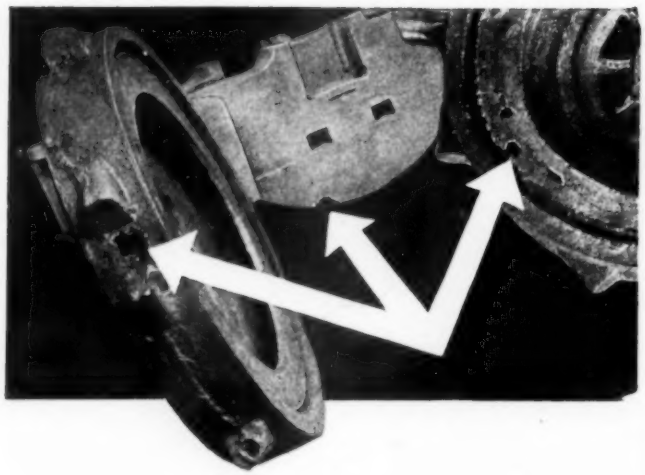

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This dense metallic filler, used like putty, hardens like the casting itself, stays firmly in place and will stand filing.

Do as leading foundrymen have been doing for half a century, restore marred casting surfaces with Smooth-On Foundry Cement, just as you remove unsightly "fins" before sending a casting out.

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If you are not already using Smooth-On Foundry Cement to finish your castings, try it. We will send you a sufficient quantity, in the shade you specify, to make a thorough test The coupon will bring you your sample.

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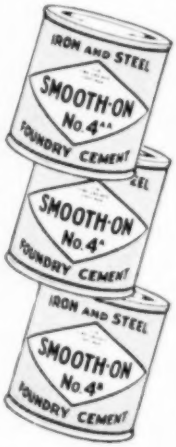

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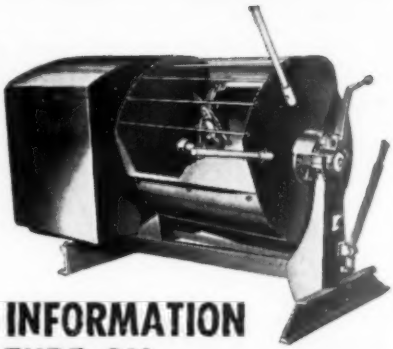

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LASTS MANY TIMES LONGER

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AMASTEEL is produced under exclusive patents and is available in sizes that meet all CLEANING and PEENING requirements.

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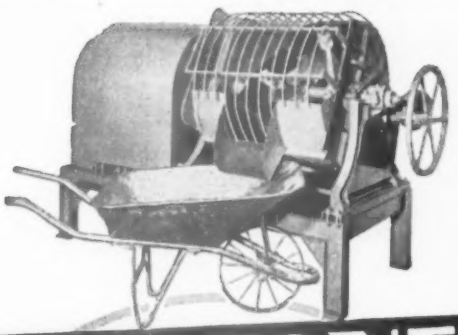

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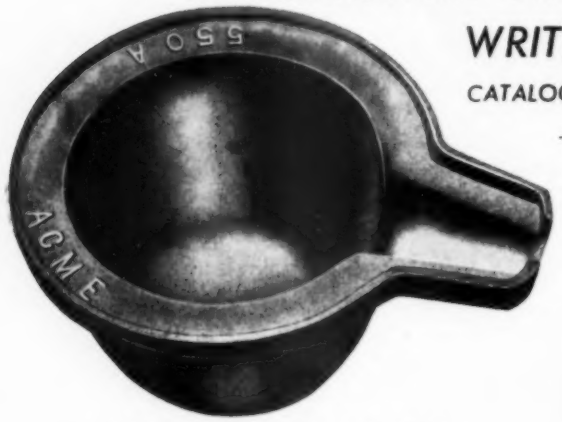

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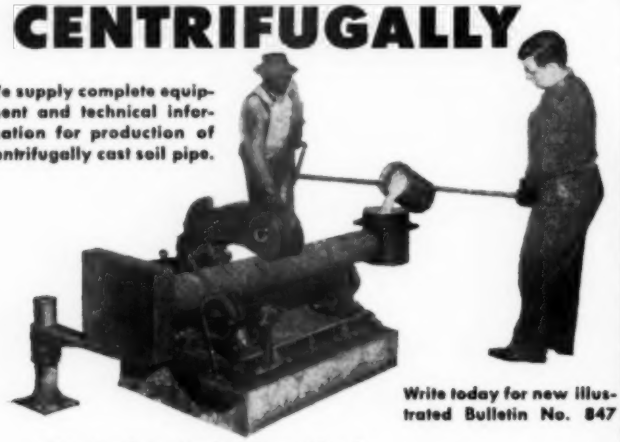

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Save AIR & TIME with *Air-O-chek* Air Guns

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HELPFUL LITERATURE

NOTE TO READERS: If you will check the item or items described which particularly interest you, we will be glad to request the manufacturers concerned to send you their literature. Use the attached postal card.

1. Industrial Trends

A. A. Wickland & Co.—Folding chart "Cavalcade of Industry" covers manufacturing industries over period from 1849 to 1946. Business trend, value of manufactured products, cost of materials, value added by manufacture, wages and other factors are indicated.

2. Gravity Conveyors

Rapids-Standard Co.—24-page illustrated catalog No. C-142-4 describes Rapid-Wheel and Rapid-Roller gravity conveyors and lists available accessories. Application views show units handling wide range of materials in all types of plants.

3. Diecasting Machine

Cleveland Automatic Machine Co.—4-page illustrated Bulletin D-446 is descriptive of model 400 universal high-pressure hydraulic diecasting machine which is convertible readily from magnesium, aluminum or bronze machine to unit for zinc, tin or lead diecastings.

4. Foundry Supplies

American Crayon Co.—16-page illustrated bulletin "Industrial Crayon Guide for a Safe Check in Modern Industry" describes crayons for marking all types of materials, chalks, metal marking sticks, inks, adhesives and plastic modeling clay.

5. Grinders & Buffers

Brown-Brockmeyer Co.—6-page illustrated bulletin No. 7000 presents brief descriptions of Toolmaster line of grinders and buffers which includes light, medium and heavy duty bench and floor model machines for wet and dry grinding and for tool grinding.

6. Air Hose

B. F. Goodrich Co.—4-page illustrated catalog section No. 3460 lists specifications and suggested applications of various types and grades of air hose. Data are included on sizes, braids and plies, weight, maximum lengths, outside diameters and working pressures.

7. Material Handling Units

LYON-Raymond Corp.—4-page illustrated bulletin No. 201 describes general line of material handling equipment which includes hydraulically operated lift trucks, pallet trucks, elevating tables, high lift trucks and sheet feeding equipment.

8. Casting Alloys

Birmingham Aluminium Casting Co.—28-page illustrated bulletin "Birmal Data" is guide to selection of suitable casting alloys in aluminum, magnesium and zinc. British trade names of line of alloys, compositions, heat treatment, mechanical and physical properties, applications and typical products are covered.

9. Positioning Equipment

Ransome Machinery Co.—36-page illustrated bulletin No. 210B describes complete line of work positioning equipment which includes sizes for products weighing less than 100 pounds up to those weighing 20 tons or more. Especially designed for weldment positioning, these machines can be used for assembling and other operations.

10. Cable Connector

Industrial Power & Equipment Co.—2-page illustrated bulletin No. 201 gives complete data on R-C-E industrial rubber-clad electrical connector which can be used on cables supplying portable, mobile or stationary machinery. Mechanically strong solderless connection is provided by this heavy duty unit.

11. Grinding Wheels

Sterling Grinding Wheel Div.—44-page illustrated bulletin "Serving American Industry" traces development of company, describes its grinding wheel production facilities, explains manufacture of abrasive products and gives data on various types and grades of grinding wheels produced for industrial use.

12. Pneumatic Vise

Van Products Co.—3-page illustrated bulletin on Vi-Speed air-operated vises explains applications of this device for work holding, assembling, pressing and other operations.

13. Stainless Wire Cloth

Buffalo Wire Works Co.—6-page illustrated bulletin No. 596 lists properties, applications and sizes of stainless steel wire cloth. Laboratory ratings of corrosion resistance to various chemicals are tabulated.

14. Conveying Equipment

Trowbridge Conveyor Co.—8-page illustrated catalog No. 755 describes both stationary and portable trough and flat belt conveyors; drag and apron conveyors. Also shown is special equipment for handling bags, barrels, etc.

15. Hose Couplers

Snap-Tite, Inc. — 4-page illustrated folder No. 45 shows and presents data on swivel ball bearing hose couplers for steam, air, water, oil, grease and other hose lines. It is constructed of special alloys for high and low pressure service.

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16. Tractor Shovels

Frank G. Hough Co.—8-page illustrated bulletin No. 162 describes model HA Payloader tractor shovel designed for loading, carrying and dumping bulk materials of all types. Small and compact, it will operate in congested areas, inside box cars, along narrow foundry aisles and in storage bins.

17. Grinding Machines

Grinding Wheel Manufacturers Association—20-page illustrated booklet "Portable Grinding Machines" shows correct and incorrect methods of mounting grinding wheels on portable machines, discusses means of avoiding wheel breakage, describes protective devices and methods, and includes tables for conversion of revolving speeds to surface feet per minute for wheels from 1 to 8 inches in diameter.

18. Axial Flow Fans

Propellair Div., Robbins & Myers, Inc.—68-page illustrated catalog No. 12 contains information on complete line of Airfoil propeller axial flow fans, guards, automatic shutters, and Verti-Stack roof ventilators. Engineering data, charts and tables for calculation of ventilating systems are included.

19. Metal Fabricating

Phillips Mill & Mine Supply Co.—8-page illustrated bulletin No. F-347 shows metal fabricating facilities of company and describes machines manufactured which include press brakes, shears, machine tools, bulldozers and presses.

20. Building Maintenance

Stonhard Co.—48-page illustrated booklet "Over the Rough Spots" provides answers to many problems in maintenance and construction of all types of industrial buildings. Data are given on floors, walls, foundations and roofs. Floor resurfacers, waterproofing materials, cement hardeners, masonry repair materials, roofing compounds, etc. are described.

21. Small Mobile Crane

Hyster Co.—36-page illustrated bulletin "Hyster Karry Krane in Foundries & Forge Plants" shows action pictures of these mobile cranes which lift and move loads weighing up to 10,000 pounds. Applications of equipment in all types of foundry and forge shop departments are covered.

22. Washroom Equipment

Bradley Washfountain Co.—24-page illustrated catalog No. 4701 describes complete line of Washfountains, Multi-Stall showers and drinking fountains which are designed specifically for industrial use. Specification data and washroom planning suggestions are included.

23. Casting Resin

Durez Plastics & Chemicals, Inc.—12-page illustrated catalog "Durez Casting Resin" is technical discussion with full instructions included for use of casting resin No. 7421 A. Material is phenolic thermosetting resin in liquid form which is used without pressure.

24. Abrasive Belt Finishing

Minnesota Mining & Mfg. Co.—20-page illustrated bulletin "Step Up Production" explains 3M backstand method of grinding and polishing. Nine photographic case studies show how finishing time was reduced 30 to 80 per cent by using this method.

25. Metal Cutting Saw

Johnson Mfg. Corp.—8-page illustrated bulletin "Faster, More Efficient Cutting" provides check list of advantages offered by metal cut-off band saw which has capacity of up to 10 x 18 inches. Both wet and dry cutting models are available.

26. Paint Finishing Equipment

Peters-Dalton, Inc.—12-page illustrated bulletin No. 501 is entitled "Planned Systems for Complete Paint Finishing." Details are given on metal preparation and washing machines, paint spray booths, and drying and baking ovens.

27. Welding & Cutting

Victor Equipment Co.—20-page illustrated bulletin "A Presentation of Welding & Cutting Equipment by Victor" describes various types of oxyacetylene welding and cutting outfits, explains their capacities and gives details of broad range of torches.

28. Fire Extinguishers

C-O-Two Fire Equipment Co.—8-page illustrated vest-pocket size folder entitled "Kills Fire Saves Life" deals with hand and wheel type carbon dioxide fire extinguishing equipment as well as hose and reel systems and wall mounted hand operated units.

29. Magnetic Pulley

Eriez Mfg. Co.—8-page illustrated bulletin No. 501A shows how tramp iron or other ferrous metal contamination can be removed automatically from materials in process. Principles of design and operation, specifications, capacities, dimensions and weights are included.

30. Industrial Trucks

Service Caster & Truck Corp.—24 page illustrated catalog "The New Service MoTow Lift Measures Up" describes industrial truck for wide variety of foundry applications. Units are gas powered, standard automotive designed, have maximum visibility and are powerful.

31. Signal & Control Equipment

Autocall Co.—8-page illustrated brochure covers line of electrical signal and control equipment for public utility and industrial power plants. Wide range of audible, visual, indicating and recording equipment is described briefly.

32. Dust Control & Ventilation

Claude B. Schneible Co.—32-page illustrated catalog No. 47 shows how effective dust control and ventilation are applied to various foundry departments. Installations depicted are for mold conveyor unit including sand handling, preparation of shakeout, cupola, melting department, core room, cleaning room and grinding operations. Complete equipment for various functions is described.

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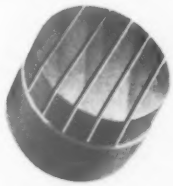

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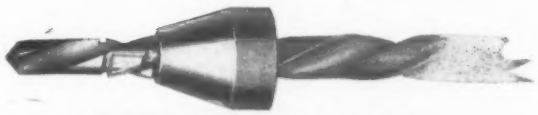

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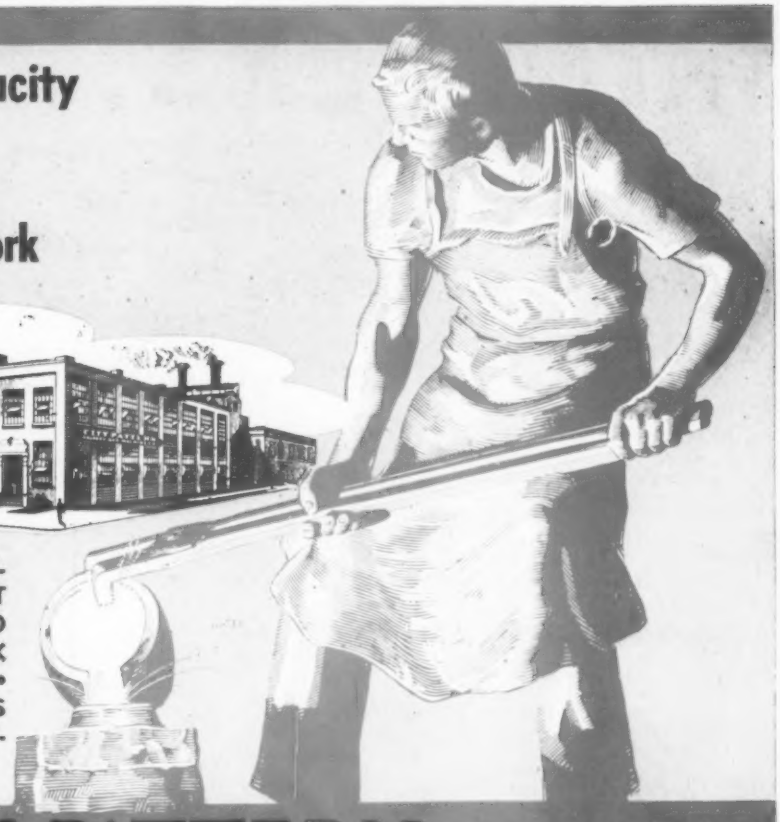

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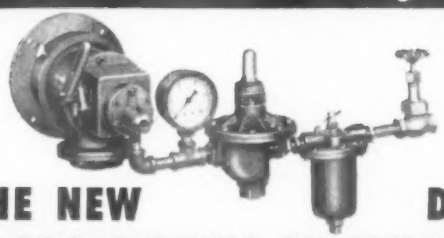

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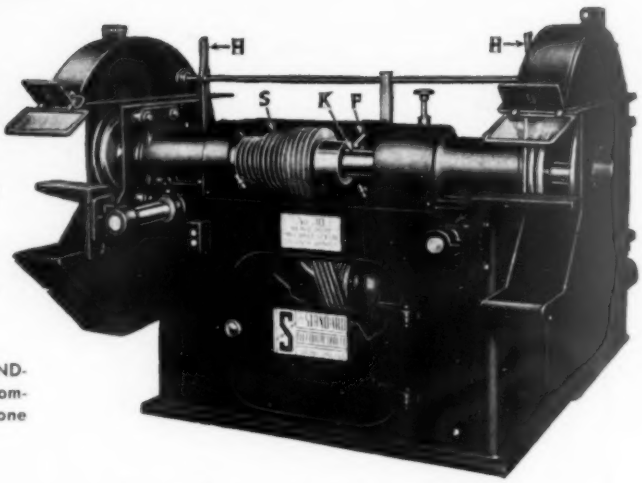

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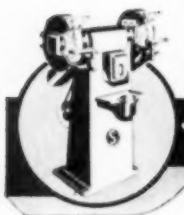

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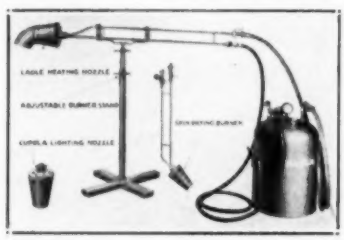

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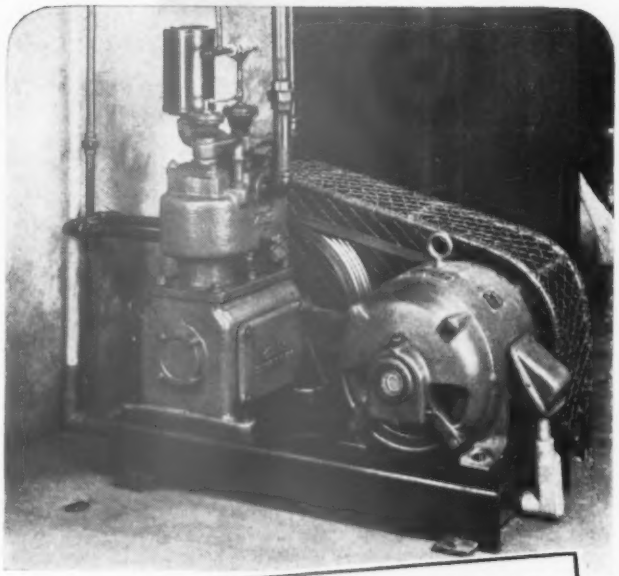

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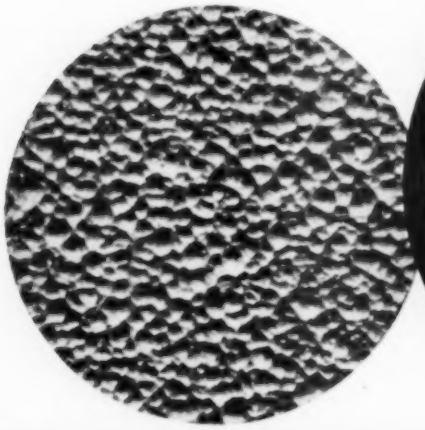

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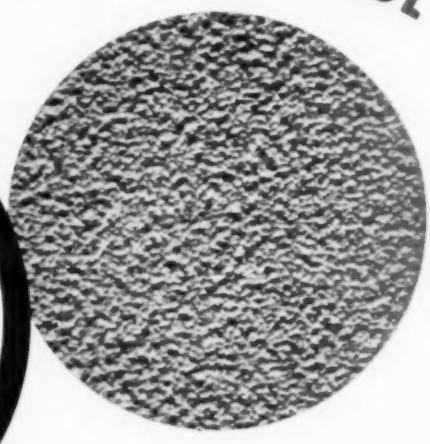

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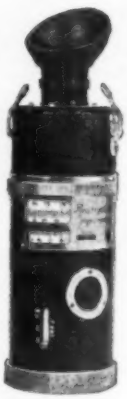

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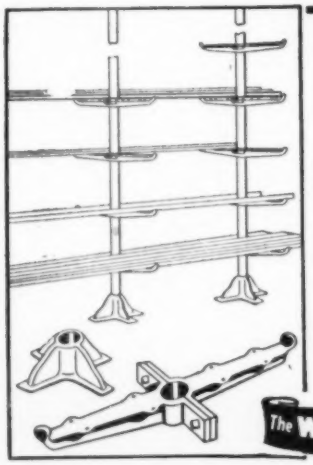

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You save on costs of shot and grit because every pellet does its job

AMERICAN STEEL ABRASIVES last longer because the pellets are *uniform* in size and hardness. American's own method of manufacture controls the factors which are important to uniformity and durability. Every pellet does its share. Make sure you get all the blast cleaning efficiency and abrasive economy that American offers. All sizes graded to new S.A.E. specifications

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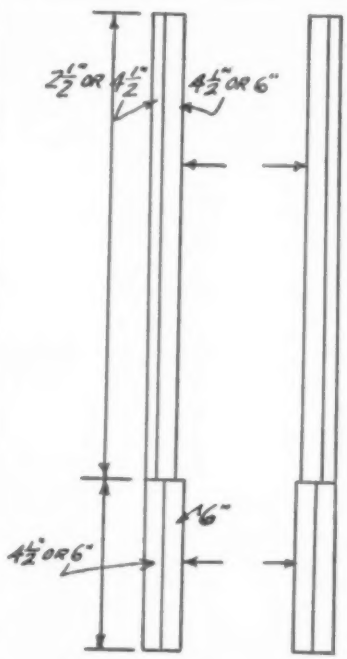

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SPECIAL TYPE *for* FOUNDRY SERVICE

The Williams "Hook-on" Single Line Bucket is designed especially for foundry service in 3/8 to 2 cubic yard capacities. Its many features of design and construction are described in an illustrated bulletin sent free on request. Write

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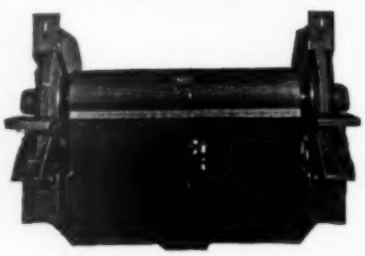
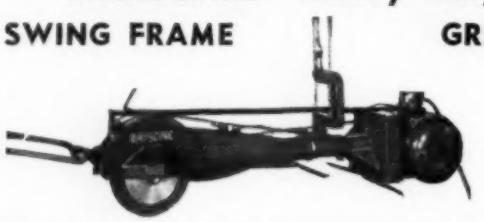
designed to cut your grinding costs

MARSCHKE "Vari-Speed" FLOOR STAND GRINDER



Massive, well-designed construction combined with dependable automatic spindle speed control, make this powerful machine the most efficient heavy duty floor-stand grinder made.

MARSCHKE "Heavy Duty" SWING FRAME GRINDER



This machine, famous for its convenience in "taking the wheel to the work", is as efficient as it is powerful and dependable.

Write for more detailed information . . . about these two and other Marschke cost-cutting grinders.

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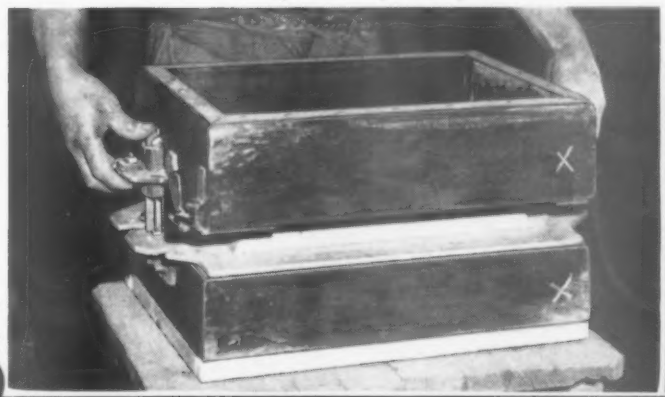

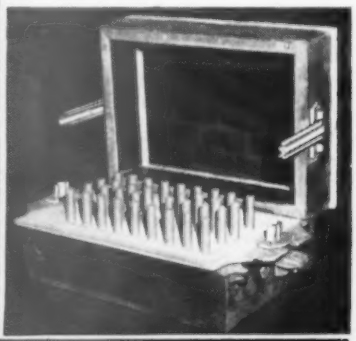

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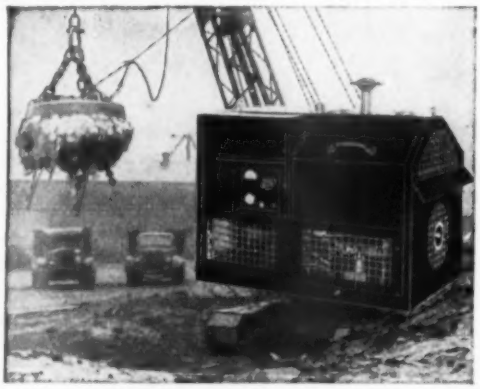

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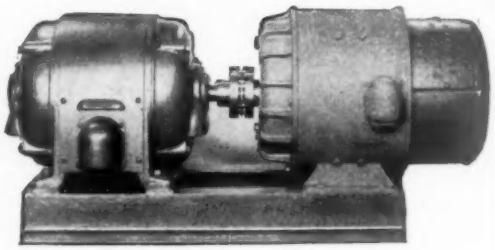

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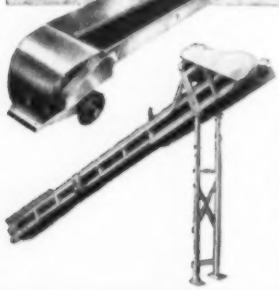

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Frederic B. Stevens, Inc., Detroit 26, Mich.
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Jackson Iron & Steel Co., Jackson, O.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Ohio Ferro-Alloys Corp., Canton 2, O.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTITANIUM

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FERROTUNGSTEN

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America, Pittsburgh 19, Pa.

FERROVANADIUM

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

FILLET (Wax, leather, wood)

PMS Co., 1701 Power Ave., Cleveland 14, O.

FILM (X-Ray)

Eastman Kodak Co., Rochester, N. Y.

FILTERS (Air)

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.

FINISHING EQUIPMENT

Newcomb-Detroit Co., Inc., 5741 Russell St., Detroit 11, Mich.

FIRE BRICK

Carborundum Co., Perth Amboy, N. J.
Davis Fire Brick Co., Oak Hill, Ohio
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.
Norton Co., Worcester 6, Mass.
Robinson Clay Products Co., 1100 Second National Bldg., Akron, Ohio.
Stevens, Inc., Frederic B., Detroit 26, Mich.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati, Ohio

FIRE CLAY

Eastern Clay Products, Inc., Jackson, O.
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.
Robinson Clay Products Co., 1100 Second National Bldg., Akron, Ohio
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati, Ohio

FIRE SAND

Carborundum Co., Niagara Falls, N. Y.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FIRESTONE

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FLASK BANDS

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, Ohio

FLASK BUSHINGS

Hines Flask Co., 1324 Hird Ave., Cleveland 7, Ohio
Universal Engineering Co., Frankenmuth, Mich.

FLASK PINS

Diamond Clamp & Flask Co., Richmond, Ind.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, Ohio
Universal Engineering Co., Frankenmuth, Mich.

FLASKS (Aluminum)

Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.

FLASK FILLERS

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.

FLASKS (Slip)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Freeman Supply Co., Toledo 5, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.
Arcade Manufacturing Div. Rockwell Mfg. Co., Freeport, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Stevens, Inc., Frederic B., Detroit 26, Mich.
United Pattern Works, 2309 Russell St., Detroit 7, Mich.

FLASKS (Steel)

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio

FLASK FITTINGS

Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio

FLASK LIFT MACHINES

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

FLASK LUMBER

Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.

FLASKS (Wood)

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.

FLEXIBLE SHAFT MACHINERY

Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
Strand Co., N. A., 5001 N. Wolcott Ave., Chicago 40, Ill.

FLOORING (Non-Slip)

Norton Co., Worcester 6, Mass.

FLUXES

Carbon Limestone Co., Youngstown, Ohio
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Foundry Services, Inc., 280 Madison Ave., New York 16, N. Y.
Matheson Alkali Works, Inc., 60 E. 42nd St., New York 17, N. Y.
National Pigment Co., East York St., Philadelphia, Pa.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

FOUNDRY COAL (Anthracite)

Hudson Coal Co., Scranton, Pa.

FOUNDRY LAYOUT & METHODS

Engineering Service Inc., 610 West Michigan St., Milwaukee 3, Wis.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY NAILS

Standard Horse Nail Corp., New Brighton, Pa.

FOUNDRY SHOVELS

(See SHOVELS)

FOUNDRY SYSTEMS

Engineering Service Inc., 610 West Michigan St., Milwaukee 3, Wis.

FOUNDRY SUPPLY HOUSES

Buckeye Products Co., 7022 Vine [illegible] Cincinnati 16, Ohio.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Freeman Supply Co., 1152 E. Broadway, Toledo 5, O.
Stevens, Inc., Frederic B., Detroit 26, Mich.

FURNACES (Aluminum & Magnesium Billets)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., W. Wilson St., Salem, Ohio.

FURNACES (Aluminum & Magnesium Forgings)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., W. Wilson St., Salem, Ohio.

FURNACES (Aluminum Melting)

Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.

FURNACES (Aluminum Rivet Heating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Despatch Oven Co., Minneapolis 14, Minn.

FURNACES (Annealing)

Campbell-Hausfeld Co., Harrison, Ohio.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
56 Church St., New York 7, N. Y.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Crucible Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Eclipse Fuel Engrg. Co., 711 So. Main St., Rockford, Ill.
Fen Machine Co., 1350 Babbitt Rd., Cleveland 17, Ohio
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Johnston Mfg. Co., Minneapolis 13, Minn.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.

FURNACES (Electric Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.

FURNACES (Electric Melting) (Cont'd.)

Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Gas or Oil Fired)

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Denver Fire Clay Co., 2301 Blake St., Denver, Colo.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
Fen Machine Co., 1350 Babbitt Rd., Cleveland 17, Ohio.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.

FURNACES (Gray Iron Melting)

American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Heat Treating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.

FURNACES, HEAT TREATING (Electric)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Malleable Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
General Electric Co., Schenectady, N. Y.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.
Young Brothers Co., 6508 Mack Ave., Detroit 7, Mich.

FURNACES (Malleable Melting)

American Bridge Co., Pittsburgh 19, Pa.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Trenton, N. J.

FURNACES (Nonferrous Melting) (Cont'd.)

Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Fen Machine Co., 1350 Babbitt Rd., Cleveland 17, Ohio.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Johnston Mfg. Co., Minneapolis 13, Minn.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Powdered Coal)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Steel Melting)

Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACE BLOWERS

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Roots-Connersville Blower Corp., Connersville, Ind.

FURNACE BOTTOMS

Industrial Silica Corp., Stambaugh Bldg., Youngstown, O.

FURNACE LININGS

Campbell-Hausfeld Co., Harrison, O.
Carborundum Co., Perth Amboy, N. J.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Ironton Fire Brick Co., Ironton, O.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.
United States Graphite Co., Saginaw, Mich.

GAGES

Acme Aluminum Alloys Inc., Dayton 3, Ohio.
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio

GAGGERS

Federal Foundry Supply Co., 4600 E. 71st., Cleveland 5, O.

GAS

American Gas Association, 420 Lexington Ave., New York 17, N. Y.

GAS (Oxygen, Acetylene, Industrial)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

GAS BURNERS

Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Fisher Furnace Co., 2543 West Hubbard St., Chicago 12, Ill.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

GLOVES (Industrial, Safety)

American Optical Co., Southbridge, Mass.

GLUE (Liqui-Plastic)

Wellman Products Co., 1444 E. 49th St., Cleveland 3, O.

GOGGLES and EYE PROTECTORS

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.
Wilson Products Inc., Reading, Pa.

GRAPHITE

Asbury Graphite Mills, Asbury, N. J.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17.
Superior Flake Graphite Co., 33 S. Clark St., Chicago 3, Ill.
United States Graphite Co., Saginaw, Mich.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17, N. Y.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio
Standard Electrical Tool Co., 2488 Riverside Ave., Cincinnati 4, Ohio.
U. S. Electrical Tool Co., Cincinnati 4, O.

GRINDERS (Flexible Shaft)

Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
N. A. Strand Co., 5001 N. Wolcott Ave., Chicago 40, Ill.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio

GRINDERS (Surface, Bench, Disc, Floor)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
Standard Electrical Tool Co., 2488 Riverside Ave., Cincinnati 4, Ohio.
N. A. Strand Co., 5001 N. Wolcott Ave., Chicago 40, Ill.
U. S. Electrical Tool Co., Cincinnati 4, O.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDERS (Swing Frame)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDING WHEELS—See ABRASIVE WHEELS

GRINDING WHEEL DRESSERS

Carborundum Co., Niagara Falls, N. Y.
Desmond-Stephan Mfg. Co., Urbana, O.
Vincent Steel Process Co., 2424 Bellevue St., Detroit 7, Mich.
Western Tool & Mfg. Co., Springfield, Ohio.

GRINDSTONES

Bay State Abrasive Products Co., Westboro, Mass.
Sterling Grinding Wheel Div., Cleveland Quarries Co.

GRIT (Abrasive)

Alloy Metal Abrasive Co., Ann Arbor, Mich.
American Steel Abrasives Co., Galion, O.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Carborundum Co., Niagara Falls, N. Y.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio
Globe Steel Abrasive Co., Mansfield, O.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
National Metal Abrasive Co., 3560 Norton Ave., Cleveland 7, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.

HAMMERS (Chipping)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas
Davton Pneumatic Tool Co., Dayton 1, Ohio.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

HEAT CONTROL AND RECORDING DEVICES

Foxboro Company, Foxboro, Mass.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 9, Ill.
Illinois Testing Laboratories, 418 N. LaSalle St. Chicago 10, Ill.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

HEATERS (Gas, Oil, Electric)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Despatch Oven Co., Minneapolis 14, Minn.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

HEATERS (High Frequency Electric)

Ajax Electrothermic Corp., Trenton, N. J.

HEATERS (Indirect Fired)

Despatch Oven Co., Minneapolis 14, Minn.

HEATERS (Space, Unit, Direct Fired)

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

HEATERS (Space, Unit, Oven, Water)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.

HELMETS (Blasting)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
American Optical Co., Southbridge, Mass.
Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

HELMETS (Welding)

American Optical Co., Southbridge, Mass.

HOISTS (Air)
Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17.
Curtis Pneumatic Machinery Co., 1922 Kienlen Ave., St. Louis 20, Mo.
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6 Ill
Ingersoll-Rand Co., 11 Broadway, New York 4. N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

HOISTS (Chain)
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.

HOISTS (Electric)
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Conco Engineering Works, Mendota, Illinois
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Modern Equipment Co., Port Washington, Wis.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

HOISTS (Hand)
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Clipper Mfg Co., 2800 Warwick St., Kansas City 8, Mo.

HOSE (Air, Blasting, Water, Gas)
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pangborn Corp., Hagerstown, Md.
Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.
Schramm Inc., West Chester, Pa.

HYDRAULIC CLEANING EQUIPMENT
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
N. Ransohoff Inc 208 W. 71st St., Cincinnati 16, O.

ILLUMINATORS (X-Ray Film)
Eastman Kodak Co., Rochester, N. Y.

IMPREGNATING SYSTEMS
Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.

INDUSTRIAL ENGINEERING SERVICE
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

INGOT MOLDS
Acme Foundry Co., Detroit 16, Mich.

INGOTS (Nonferrous)
Ajax Metal Co., Philadelphia 23, Pa.
Aluminum Company of America, Pittsburgh, Pa
Aluminum & Magnesium Inc., Sandusky, O.
American Smelting & Refining Co., 120 Broadway, New York 5.
Apex Smelting Co., Chicago, Ill.
Cleveland Electro Metals Co., W. 38th St. & NP RR. Cleveland 13, O.
Federated Metals Div., American Smelting & Ref. Co., New York 5.
General Smelting Co., Philadelphia, Pa.
International Nickel Co., Inc., 67 Wall St., New York City 5.

INGOTS (Nonferrous) (Cont'd.)
Jobbins, Wm. F., Inc., Aurora, Ill.
Lavin & Sons R., Inc., Chicago, Ill.
National Smelting Co., Cleveland, O.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, New York.
Silverstein & Pinsof, Inc., 1720 N. Elston, Chicago 22, Ill.
U. S. Metals Refining Co., New York.
U. S. Reduction Co., E. Chicago, Ind.

INJECTION MOLDING MACHINES
Lester-Phoenix Inc., 2711 Church St. Cleveland 13, Ohio.

INOCULANTS
Carborundum Co., Perth Amboy, N. J.

IRON CEMENT
Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.

IRON ORE
Bethlehem Steel Co., Bethlehem, Pa.
Pickands, Mather & Co., Cleveland 14, O.

INSPECTION SERVICE (X-Ray)
Auto Specialties Mfg. Co., St. Joseph, Mich.

IRON OXIDES
Chicago Mfg. & Distributing Co., 1928 W 46th St., Chicago 9, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.

JACKETS (Mold)
Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
United Pattern Works, 2309 Russell St., Detroit 7, Mich.

LABORATORY EQUIPMENT (Chemical)
Buehler, Ltd., 228 N. LaSalle St., Chicago 1, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave. Detroit 4, Mich.
Precision Scientific Co., 3737 Courtland St., Chicago 47, Ill.

LABORATORY EQUIPMENT (Physical)
Buehler, Ltd., 228 N. LaSalle St., Chicago 1, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Norton Co. Worcester 6, Mass.
Precision Scientific Co., 3737 Courtland St., Chicago 47, Ill.

LADLES
Bethlehem Steel Co., Bethlehem, Pa.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Industrial Equipment Co., Minster, O.
Modern Equipment Co., Port Washington, Wis.
Frederic B. Stevens, Inc., Detroit 26, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE HEATERS
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE LININGS
Ironton Fire Brick Co., Ironton, Ohio.

LATHE CENTERS
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

LEAD
American Smelting & Refining Co., 120 Broadway, New York 5.

LETTERS (Pattern)
Wellman Products Co., 1444 E. 49th St., Cleveland 3, O.

LIMESTONE
Carbon Limestone Co., Youngstown, Ohio

LOADERS
Clearfield Machine Co., Clearfield, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

LUBRICANTS (Industrial)
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Swan-Finch Oil Corp., R. C. A. Bldg., West, New York 26, N. Y.
United States Graphite Co., Saginaw, Mich.

LUMBER (All kinds)
Dougherty Lumber Co., 4300 East 68th St., Cleveland 5, O.

MACHINE KEYS
Standard Horse Nail Corp., New Brighton, Pa.

MACHINERY MOUNTING PADS
Fabreeka Products, Inc., 22B Summer St., Boston, Mass.

MAGNESIUM (Ingots)
Apex Smelting Co., 2534 Filmore St., Chicago 12, Ill.

MAGNET CONTROLLERS
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MAGNET GENERATORS
Power Plants Inc., 1755 E. 33rd St., Cleveland 14, Ohio.

MAGNETS
Dings Magnetic Separator Co., 4740 W. McGeough, Milwaukee 7, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

MANGANESE (Briquets)
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.

MATCHPLATES
Acme Aluminum Alloys Inc., 232 North Findlay St., Dayton 3, Ohio.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3, O
Pressure Cast Products Co., 1028 Vermont Ave. Detroit 16, Mich.
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Royer Foundry & Machine Co.,
Kingston, Pa.

SAND PREPARATION EQUIPMENT

Ajax Flexible Coupling Co.,
Westfield, N. Y.
Allis Chalmers Mfg. Co.,
Milwaukee 1, Wis.
American Wheelabrator & Equipment Co., 505 S. Byrkit St.,
Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Bartlett & Snow Co., C. O., 6201
Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424
N. Cicero, Chicago 39, Ill.
Clearfield Machine Co.,
Clearfield, Pa.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth
St., Columbus 16, O.
Moulders Friend,
Dallas City, Ill.
National Engineering Co., 549 W.
Washington St., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton
Ave., Cleveland 14, O.
Royer Foundry & Machine Co.,
Kingston, Pa.
Screen Equipment Co.,
Buffalo 21, N. Y.
Simplicity Engineering Co.,
Durand, Mich.

SAND RAMMERS

Chicago Mfg. & Distributing Co.,
1928 W. 46th St., Chicago 9, Ill.
Chicago Pneumatic Tool Co.,
General Offices: 8 East 44th St.,
New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed
Roller Bit Co., Houston, Texas
Dayton Pneumatic Tool Co.,
Dayton 1, O.
Herman Pneumatic Machine Co.,
Union Bank Bldg.,
Pittsburgh 22, Pa.
Rotor Tool Co., 17325 Euclid Ave.,
Cleveland 12, Ohio

SAND RECLAIMERS

Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St.,
Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
National Engineering Co., 549 W.
Washington St., Chicago 6, Ill.
Nichols Engineering & Research
Corp., 60 Wall Tower,
New York 5, N. Y.
Stearns Magnetic Mfg. Co.,
662 S. 28th St., Milwaukee 4, Wis.

SAND SIFTING and SCREENING MACHINERY

Allis-Chalmers Mfg. Co.,
Milwaukee 1, Wis.
American Air Filter Co., 266 Central
Ave., Louisville 8, Ky.
Bartlett & Snow, C. O., Co.,
6201 Harvard Ave.,
Cleveland 5 Ohio.
Beardsley & Piper Co.,
2424 No. Cicero,
Chicago 39, Ill.
Champion Foundry & Machine Co.,
1314 W 21st St., Chicago 8, Ill.
Federal Foundry Supply Co.,
4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co.,
2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co.,
Leavenworth, Kansas.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
National Engineering Co., 549 W.
Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co.,
Kingston, Pa.
Screen Equipment Co.,
Buffalo 21, N. Y.
Simplicity Engineering Co.,
Durand, Mich.
Pangborn Corp., Hagerstown, Md.
Whiting Corporation,
15607 Lathrop Ave., Harvey, Ill.

SAND STORAGE BINS & GATES

Bartlett & Snow, C. O., Co.,
6201 Harvard Ave.,
Cleveland 5, Ohio.
Beardsley & Piper Co., The, 2424
N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St.,
Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
National Engineering Co., 549 W.
Washington St., Chicago 6, Ill.
Neff & Fry Co., Camden, O.

SAWS (Band, Metal, Wood)

Atlantic Saw Mfg. Co.,
New Haven, Conn.
Do All Company,
Des Plaines, Ill.
Oliver Machinery Company,
Grand Rapids 2, Mich.

SAWS (Cold Metal)

Bethlehem Steel Co., Bethlehem, Pa.
Do All Company,
Des Plaines, Ill.
Tabor Mfg. Co., 6225 Tacony St.,
Philadelphia 35, Pa.

SAWS (Masonry)

Clipper Mfg. Co., 2800 Warwick St.,
Kansas City 8, Mo.

SCALING HAMMERS

Independent Pneumatic Tool Co.,
600 West Jackson Blvd.,
Chicago 6, Ill.
Joy Mfg. Co., Sullivan Division,
Michigan City, Ind.
Rotor Tool Co., 17325 Euclid Ave.,
Cleveland 12, Ohio
Schramm, Inc., West Chester, Pa.

SCREENS (Shake-Out)

Allis Chalmers Mfg. Co.,
Milwaukee 1, Wis.
C. O. Bartlett & Snow Co.,
6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424
N. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., 907 N. Fourth St.,
Columbus 16, O.
National Engineering Co., 549 W.
Washington St., Chicago 6, Ill.
Screen Equipment Co.,
Buffalo 21, N. Y.
Simplicity Engineering Co.,
Durand, Mich.

SCREENS (Vibrating)

Ajax Flexible Coupling Co.,
Westfield, N. Y.
Allis Chalmers Mfg. Co.,
Milwaukee 1, Wis.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
Robins Conveyors, Inc.,
70 Pine St., New York 5, N. Y.
Screen Equipment Co.,
Buffalo 21, N. Y.
Simplicity Engineering Co.,
Durand, Mich.

SCREW MACHINE PRODUCTS

Wellman Products Co.,
1444 E. 49th St., Cleveland 3, O.

SEA COAL

Federal Foundry Supply Co.,
4600 E. 71st St., Cleveland 5, O.
Smith Facing & Supply Co.,
1857 Carter Rd., Cleveland 13, O.
Frederic B. Stevens, Inc.,
Detroit 26, Mich.

SEPARATORS (Abrasive)

American Wheelabrator & Equipment Co., 505 S. Byrkit St.,
Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Air, Moisture, Oil)

American Air Filter Co., 266 Central
Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St.,
Mishawaka, Ind.
Chicago Mfg. & Distributing Co.,
1928 W. 46th St., Chicago 9, Ill.
Jas. A. Murphy & Co.,
Hamilton, O.
Pangborn Corp., Hagerstown, Md.

SEPARATORS (Magnetic)

Beardsley & Piper Co., The, 2424
No. Cicero, Chicago 39, Ill.
Dings Magnetic Mfg. Co.,
4740 W. McGeough,
Milwaukee 7, Wis.
National Engineering Co.,
549 W. Washington St.,
Chicago 6, Ill.
Stearns Magnetic Mfg. Co.,
662 S. 28th St., Milwaukee 4, Wis.

SHAKE-OUT MACHINERY

Allis-Chalmers Mfg. Co.,
Milwaukee 1, Wis.
American Air Filter Co., 266 Central
Ave., Louisville 8, Ky.
C. O. Bartlett & Snow Co.,
6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424
No. Cicero, Chicago 39, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg.,
Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Robins Conveyors, Inc.,
70 Pine St., New York 5, N. Y.
Royer Foundry & Machine Co.,
Kingston, Pa.
Simplicity Engineering Co.,
Durand, Mich.

SHAKEOUT MACHINE MOUNTING PADS

Fabreeka Products, Inc.,
22B Summer St., Boston, Mass.

SHOCK ABSORBING PADS

Fabreeka Products, Inc.,
22B Summer St., Boston, Mass.

SHOES (Safety)

Titan Safety Shoe Co.,
212 Essex St., Boston 11, Mass.

SHOT AND GRIT

Alloy Metal Abrasive Co., 311 W.
Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., 505 S. Byrkit St.,
Mishawaka, Ind.
American Steel Abrasives Co.,
Galion, O.
Carpenter Brothers, Inc., 606 West
Wisconsin, Milwaukee 3, Wis.
Cleveland Metal Abrasive Co.,
887 E. 67th St., Cleveland, Ohio
Globe Steel Abrasive Co.,
Mansfield, O.
Hickman-Williams & Co.,
Union Commerce Bldg.,
Cleveland 14, O.
National Metal Abrasive Co.,
3560 Norton Ave.,
Cleveland 7, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co.,
Pittsburgh 1, Pa.
Sly Mfg. Co., W. W.,
4753 Train Ave., Cleveland 2, O.
Steel Shot & Grit Co. Inc.,
39 Warren Ave., Boston, Mass.

SHOT (Peening)

Alloy Metal Abrasive Co., 311 W.
Huron St., Ann Arbor, Mich.
American Foundry Equipment Co.,
505 S. Byrkit St.,
Mishawaka, Ind.
American Steel Abrasives Co.,
Galion, O.
Cleveland Metal Abrasive Co.,
887 E. 67th St., Cleveland, Ohio
Globe Steel Abrasive Co.,
Mansfield, Ohio.
National Metal Abrasive Co.,
3560 Norton Ave.,
Cleveland 7, O.
Pittsburgh Crushed Steel Co.,
Pittsburgh 1, Pa.
Steel Shot & Grit Co., Inc.,
39 Warren Ave.,
Boston, Mass.

SHOVELS

Federal Foundry Supply Co.,
4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc.,
Detroit 26, Mich.

SHOVELS (Power)

Clark Tructractor Div. of Clark
Equipment Co., Battle Creek,
Mich.

SILICA FLOUR

Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So.
LaSalle St., Chicago 4, Ill.
Wedron Silica Co.,
38 So. Dearborn St., Chicago, Ill.

SILICON (Briquets)

Electro Metallurgical Sales Corp.,
30 E. 42nd St., New York 17, N. Y.

SILICON CARBIDE (Briquets)

Carborundum Co.,
Perth Amboy, N. J.

SILVERY PIG IRON see Pig Iron (Silvery)

SKIMMER BARS

Chicago Mfg. & Distributing Co.,
1928 W. 46th St., Chicago 9, Ill.

SKIMMERS

Chicago Mfg. & Distributing Co.,
1928 W. 46th St., Chicago 9, Ill.
Tamms Silica Co., 228 N. LaSalle
St., Chicago 1, Ill.

SKIP HOISTS

Beardsley & Piper Co., The, 2424
No. Cicero, Chicago 39, Ill.
Gardner-Denver Co.,
Gardner Drive, Quincy, Ill.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
National Engineering Co., 549 W.
Washington St., Chicago 6, Ill.
Whiting Corporation,
15607 Lathrop Ave., Harvey, Ill.

SLIP FLASKS

Adams Co., Dubuque, Iowa.
Hines Flask Co., 1324 Hird Ave.,
Cleveland 7, O.

SLINGS (Chain)

Jeffrey Mfg. Co., 907 N. Fourth St.,
Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
S. G. Taylor Chain Co.,
Hammond, Ind.

SLIP JACKETS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co.,
1928 W. 46th St., Chicago 9, Ill.
Federal Foundry Supply Co.,
4600 E. 71st St., Cleveland 5, O.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave.,
Cleveland 7, O.

SMELTERS & REFINERS

American Smelting & Refining Co.,
120 Broadway, New York 5.
Niagara Falls Smelting & Refining
Corp., 2204 Elmwood Ave.,
Buffalo 17, N. Y.

SNAGGING WHEELS—See ABRASIVE WHEELS

SNAP FLASKS

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co.,
Richmond, Ind.
Hines Flask Co., 1324 Hird Ave.,
Cleveland 7, O.

SODA ASH

Mathieson Alkali Works, Inc.,
60 E. 42nd St., New York 17, N. Y.

SOLDER

American Smelting & Refining Co.,
120 Broadway, New York 5.

SPACE HEATERS

Dravo Corporation,
Neville Island,
Pittsburgh 25, Pa.

SPECIAL FOUNDRY ALLOYS

Vanadium Corp. of America, 420
Lexington Ave., New York, N. Y.

SPIEGELEISEN

Electro Metallurgical Sales Corp., 30
E. 42nd St., New York 17, N. Y.

SPRAY GUNS

Murphy & Co., Jas. A.,
Hamilton, O.
New Haven Vibrator Co., 131
Chestnut St., New Haven 7,
Conn.

SPRUE CUTTERS

Adams Co., Dubuque, Iowa.
Freeman Supply Co.,
Toledo 5, O.
Milwaukee Chaplet & Mfg. Co.,
1023 S. 40th St.,
Milwaukee, Wis.

STEEL (High Speed)

Bethlehem Steel Co., Bethlehem, Pa

STEEL (Structural)

Alter Company, 1702 Rockingham
Rd., Davenport, Iowa.
American Bridge Co.,
Pittsburgh 19, Pa.

STRIPPING MACHINES

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

SURFACE TREATMENT METALS

N. Ransohoff, Inc., 208 W. 71st St., Cincinnati 16, O.

TAPER PINS

Standard Horse Nail Corp., New Brighton, Pa.

TEMPERATURE CONTROLLERS

Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane Columbus 1, O.

TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.

TESTING LABORATORIES

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

TESTING MACHINES (Tensile)

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.

THERMOCOUPLES

Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Tamms Silica Co., 228 N. LaSalle St., Chicago 1, Ill.

TIERING MACHINES (Power)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TIMERS (Electric)

Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.

TIN

American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.

TONGS

Industrial Equipment Co., Minster, O.

TOOLS (Pneumatic Portable)

Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas
Dayton Pneumatic Tool Co., Dayton 1, O.
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

TORCHES and BURNERS (Acetylene, gas, oil)

Freeman Supply Co., Toledo 5, O.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

TOTE BOXES (see "BOXES-TOTE")

TRACTORS (Gas Powered)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TRAMRAIL SYSTEMS

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.

TRAMRAIL SYSTEMS (Cont'd.)

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

TROLLEYS

Curtis Pneumatic Machinery Co., 1922 Kienlen Ave., St. Louis 20, Mo.
Modern Equipment Co., Port Washington, Wis.

TRUCK BATTERIES (Industrial)

Electric Storage Battery Co., Allegheny Ave. at 19th St., Philadelphia 3, Pa.

TRUCK CRANES

Hughes-Keenan Co., Mansfield, Ohio

TRUCKS (Dump)

Phillips Mine & Mill Supply Co., 2227 Jane St., Pittsburgh 3, Pa.

TRUCKS (Industrial)

Buda Company, Harvey, Ill.

TRUCKS (Power Lift)

Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TRUCK WHEELS

Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TUBES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

TUMBLING BARRELS

Cleveland Chaplet & Mfg. Co., 1197 West 67th St., Cleveland 2, O.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
N. Ransohoff Inc., 208 W. 71st St., Cincinnati 16, O.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

TURNTABLES

Beardsley & Piper Co., The 2424 No. Cicero, Chicago 39, Ill.
Modern Equipment Co., Port Washington, Wis.
Newaygo Engineering Co., Newaygo, Mich.
Roto-Cast Foundry Equipment Inc., 100 Grand St., Coldwater, Mich.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

UNIT HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

UNLOADERS (Portable-Gas, Electric)

Bosworth Engineering Co., 6723 Denison Ave., Cleveland, Ohio.

VALVES (Air, Water, Steam)

Air-Way Pump & Equipment Co., 405 S. Jefferson St., Chicago 7, Ill.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

VALVES (Adjustable Orifice)

North American Mfg. Co., 4455 E. 71st St., Cleveland 4, Ohio.

VALVES (Blow-off and Cut-off)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Wm. H. Nichols Co., Richmond Hill, Long Island 18, N. Y.

VENTILATING SYSTEMS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Newcomb-Detroit Co., Inc., 5741 Russell St., Detroit 11, Mich.
Pangborn Corp., Hagerstown, Md.
Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
Swartwout Co., 18511 Euclid Ave., Cleveland 15, Ohio.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

VENTILATORS (Roof)

Swartwout Co., 18511 Euclid Ave., Cleveland 15, Ohio.

VENTS (Core Box)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Demmler & Bros., Wm., Kewanee, Ill.
C. M. Smillie & Co., 1100 Woodward Hgts. Blvd., Ferndale, Mich.

VIBRATION REDUCTION PADS

Fabreeka Products, Inc., 22B Summer St., Boston, Mass.

VIBRATORS

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Cannon Vibrator Co., 111 Power Ave., Cleveland 14, Ohio.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Davenport Machine & Foundry Co., Davenport, Iowa.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Martin Engineering Co., Kewanee, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Nichols Co., Wm. H., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S P O Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Syntron Company, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

VIBRATORS (Core Bench)

Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.

VISES (Air Operated)

Van Products Co., Erie, Pa.

WARM AIR HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

WASH ROOM EQUIPMENT

Bradley Washfountain Co., Box 732, Milwaukee 1, Wis. Milwaukee, Wis.

WAX (Core, Vent, Pattern)

PMS Co., 1701 Power Ave., Cleveland 14, O.
United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

WEDGES (Foundry)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WELDING GAS

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

WELDING APPARATUS (Electric Arc)

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.

WELDING and CUTTING APPARATUS and SUPPLIES

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

WELDING ELECTRODES (Carbon)

National Carbon Co., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.

WELDING RODS & ELECTRODES

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

WHEELBARROWS

Construction Machinery Corp., Waterloo, Iowa.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WHEELS, ABRASIVE (Cut-off)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Raybestos Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.
Norton Company, Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit, Mich.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa
Sterling Grinding Wheel Division, Cleveland Quarries Co., Tiffin, Ohio.

WHEELS (Wire)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.

WIRE BENDERS

Redford Iron & Equipment Co., 21315 W. McNichols Rd., Detroit, Mich.

WIRE BRUSHES

Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.

WIRE CUTTERS

Redford Iron & Equipment Co., 21315 W. McNichols Rd., Detroit, Mich.

WIRE MACHINERY

Economy Tool & Machine Co., Muskegon 23, Mich.

WIRE NAILS

Republic Steel Corp., Cleveland 4, O.

WOODWORKING MACHINERY

Do All Company, Des Plaines, Ill.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Oliver Machinery Co., Grand Rapids 2, Mich.

X-RAY EQUIPMENT

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.

X-RAY FILMS

Eastman Kodak Co., Rochester, N. Y.

X-RAY INSPECTION SERVICE

Auto Specialties Mfg. Co., St. Joseph, Mich.

ZINC

American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.

Classified Advertising

Help Wanted

SUPERINTENDENT NONFERROUS FOUNDRY
Qualified to take charge of large Aluminum and Brass Foundry. Must be thoroughly experienced in sand casting of aluminum, brass and bronze jobbing work and brass pressure fittings. Should have knowledge of pattern and core box equipment, be able to estimate weights from blue prints and familiar with flask design. Prefer man with good knowledge in mechanized and jobbing procedures in a nonferrous foundry. State age, experience, references, education and salary desired. Replies confidential. Address: Box 611, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN
Young man with technical or trade school training preferred, must have actual experience on foundry production. Knowledge of sand slingers desirable, but not essential. Excellent opportunity for advancement. Good wages according to ability to produce. State age, married or single and experience in detail. Correspondence confidential. Address: Box 546, The FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY METALLURGIST
Excellent opportunity for Metallurgist in electric steel Foundry located in the East. Should be capable of assuming full charge of melting, heat treating, sand control and testing in the production of small and medium sized carbon and alloy electric steel castings. All replies kept confidential. In replying give age, experience, salary desired, etc. Address: Box 526, The FOUNDRY, Cleveland 13, Ohio.

PATTERNMAKER FOREMAN
Supervisory position open for man with wood and metal supervisory experience. Must be fully qualified in all phases of patternmaking. Opening with progressive manufacturing organization located in Indiana. State complete work history, salary, etc. in first letter. Address: Box 537, The FOUNDRY, Cleveland 13, Ohio.

ASSISTANT TO PRODUCTION MANAGER
Must have experience equivalent to general superintendent of ferrous and nonferrous foundry. Apply in writing to: Box 552, The FOUNDRY, Cleveland 13, Ohio.

WORKS MANAGER
Medium sized grey iron production foundry and machine shop employing 300 men, needs overall plant manager with engineering background to take complete charge of all operations. Opportunity for qualified man. Submit experience, age and salary desired. Address: Box 607, The FOUNDRY, Cleveland 13, Ohio.

PATTERN SHOP FOREMAN
Excellent opportunity in Mid Western state for individual capable of supervising a department of approximately 20 employees. Should be familiar with both wood and metal patterns as well as gating practice in the malleable industry. Address: Box 639, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRYMAN
A completely mechanized Midwest foundry requires an experienced man in production and quality control of castings, capacity 50 tons per day. Give experience, references and salary desired. Can arrange housing. Address: Box 638, The FOUNDRY, Cleveland 13, Ohio.

ASSISTANT FOUNDRY SUPERINTENDENT
For busy steel foundry in Western Pennsylvania. Must know how to get production and be experienced in the production of good castings. This is a splendid opportunity for a go-getter with a good foundry background. Address: Box 642, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
We have the facilities for operating a large foundry for manufacturing light, grey iron castings but have been unable to do so due to lack of proper supervision. We have had many but none good. We offer a good opportunity to the man who is willing to prove he can do the work. Address: Box 649, The FOUNDRY, Cleveland 13, Ohio.

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Required by old established material producer to contact Ohio foundries. Technical school graduate or practical experience in a larger shop desirable. Salary and expenses. Please write full details. All replies will be kept confidential. Address: Box 605, The FOUNDRY, Cleveland 13, Ohio.

Help Wanted

WANTED
MALLEABLE
FOUNDRY EXECUTIVE

One of our clients, an old and well known midwest firm, is seeking a top grade plant manager. Broad experience in Malleable or Gray Iron Steel foundry operations on production basis is essential.

Position offers attractive opportunity to right man as he will be made an officer and director after proving his ability. Age 35 to 45.

Financial return will be substantial, depending on applicant.

Write in full detail immediately, giving all pertinent facts. All replies held strictly confidential.

EVERETT A. HARRINGTON
EXECUTIVE COUNSEL, INC.
PERSONNEL ENGINEERS
64 E. JACKSON BLVD.
CHICAGO, ILL. HARRISON 9177

STEEL FOUNDRY SUPERINTENDENT
Eastern steel foundry has opening for a General Superintendent to assume charge of all operations in the production of small and medium sized carbon and alloy electric steel castings. In replying give age, experience, salary desired, etc. All replies kept confidential. Address: Box 528, The FOUNDRY, Cleveland 13, Ohio.

METALLURGIST
Grey iron and semi-steel foundry now being mechanized desires to employ metallurgist to handle cupola and sand controls and such other work as is customary. Prefer young man with some experience in mechanized foundry. Permanent position. South-Central Pennsylvania location. Address: Box 403, The FOUNDRY, Cleveland 13, Ohio.

ASSISTANT METALLURGIST
Long established and successful company operating gray iron and brass foundry in New York state desires an assistant metallurgist on cupola and sand control work. Excellent assignment for a young man with some foundry experience to secure permanent employment with opportunity for advancement. Address: Box 604, The FOUNDRY, Cleveland 13, Ohio.

CORE DEPARTMENT SUPERINTENDENT
Experienced in all phases of core department operation as performed in high production automotive casting work. Complete knowledge of rigging equipment for core blowing and ability to train departmental supervisors and operators in core blowing operations is a special requirement for the position. Address: Box 617, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
Medium sized grey iron production foundry needs progressive man with technical background. Light and heavy castings modern plant. Good opportunity for qualified man. Submit experience and salary desired. Address: Box 608, The FOUNDRY, Cleveland 13, Ohio.

GENERAL FOUNDRY FOREMAN
We want a good practical foreman on squeeze machine and light jobbing floor work. Must have tact—ability to lead and willing to take responsibility. For the right man this is an excellent and rare opportunity for further advancement in our organization. In your reply state your full qualifications and salary expected. Address: Box 652, The FOUNDRY, Cleveland 13, Ohio.

CORE ROOM FOREMAN
Wanted for middlewest plant. Must be capable of taking complete charge in a production foundry handling cores up to 700 lbs. Address: Box 626, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
Bronze, aluminum jobbing foundry, large plant, New York City, thoroughly experienced man only familiar with rigging, patterns, working and running large scale jobbing production plant. Address: BOX 648, THE FOUNDRY, CLEVELAND 13, OHIO.

Help Wanted

INDUSTRIAL ENGINEER
Steel Foundry in New England has opening for Industrial Engineer with experience in establishing wage incentive plan in all departments. Preliminary work required in obtaining proper work flow, motion analysis, etc. Excellent opportunity for permanent position and advancement. In replying give all details of experience, salary desired, etc. All replies kept confidential. Address: Box 525, The FOUNDRY, Cleveland 13, Ohio.

CLEANING ROOM FOREMAN
Eastern Steel Foundry has opening for a Cleaning Room Foreman capable of handling all operations in the cleaning and heat treating of small and medium sized carbon and alloy electric steel castings. In replying give age, experience, salary desired, etc. All replies kept confidential. Address: Box 527, The FOUNDRY, Cleveland 13, Ohio.

GRINDING WHEEL SALESMAN
Large manufacturer has an opening for a Grinding Wheel Salesman in an important mid-west territory. Experience in the use or sale of abrasives is desirable. Replies will be treated with strict confidence. Our salesmen know of this advertisement.

BOX 603
THE FOUNDRY CLEVELAND 13, OHIO

FOUNDRY FOREMEN
Opportunity for competent gray iron and malleable molding foremen experienced on production. Good salary plus monthly performance bonus. Progressive midwest foundry. Address: Box 554, The FOUNDRY, Cleveland 13, Ohio.

CLEANING ROOM AND CORE ROOM FOREMAN
With side frame and bolster experience. Excellent opportunity with large foundry in Western Pennsylvania. Address: Box 567, The FOUNDRY, Cleveland 13, Ohio.

SANDSLINGER OPERATOR
Wanted to operate tractor type sandslinger. Middlewest plant. Steady work. Address: Box 627, The FOUNDRY, Cleveland 13, Ohio.

PARTNER
To manage new sand and permanent mold foundry, gray iron, aluminum and brass. Will make a very attractive proposition to right man. Must be able to invest some capital. Address: Box 581, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
FOR
GRAY IRON JOB SHOP
Foundry pours 15 tons daily, up to 5 ton castings. Man must be aggressive, able to handle men, be responsible for all departments, know sand and be able to get production. Top salary to the right man. Foundry located in N. E. Ohio district. Address: Box 659, The FOUNDRY, Cleveland 13, Ohio.

Accounts Wanted

MANUFACTURER'S REPRESENTATIVE
Young, aggressive, with 12 years of successful representation in Michigan well acquainted with automotive industry and other related industries in this area. Wish to represent grey iron foundry with open capacity. Commission basis only.

BOX 645
THE FOUNDRY CLEVELAND 13, OHIO

Long established New England pattern shop wishes to represent reliable foundries who desire Boston office. Address: Box 634, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

GENERAL MANAGER
Whose mature, profit-building, sanely aggressive qualifications will become an immediate asset to a company wishing to stabilize sales and production costs and prepare to meet future reactionary competition. Experience includes fifteen years as general manager of medium size foundry and machine companies with results that assure ability to carry complete executive responsibility and develop maximum possibilities. Address: Box 587, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Positions Wanted

FOUNDRY EXECUTIVE

Thoroughly qualified practical grey iron foundry and manufacturing executive with successful record as a plant manager. Twenty-one years' experience in manufacturing plus three years of foundry engineering. Desire to make connection with an organization who will appreciate a go-getter who can operate a plant on a sound and well organized basis. Forty-three years of age and now employed. Address: Box 618, The FOUNDRY, Cleveland 13, Ohio.

PATTERNMAKER

Capable of producing patterns in your shop that will show profit for pattern shop and foundry. Can use equipment to make good castings at lowest possible cost. Wood and metal patterns with varied experience over thirty years in small, medium and large work. Capable of estimating work layout or planning for your production. Make patterns of wood and metal and can check work and rigging for foundry. Experienced with core blowing and driers—small and large cores. Can take over small shop as working foreman or larger shop as supervisor. Can teach apprentices and handle journeymen in any size shop. Address: Box 647, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR GENERAL FOREMAN

46 years of age, 29 years' practical experience in the foundry from molder, coremaker to superintendent in general jobbing, machine and production. Good rigger on patterns, flasks and mechanized equipment. Want to make connection with a reliable company that needs a foundryman of my experience. Am available at once. Address: Box 891, The FOUNDRY, Cleveland 13, Ohio.

OPPORTUNITY

Experienced pressure cast matchplate maker. Seeking opening with company now operating or wishing to set up pressure cast shop. Thorough knowledge in all procedures in pressure casting. Will accept foreign employment. Address: Box 628, The FOUNDRY, Cleveland 13, Ohio.

METALLURGIST

Graduate, over 10 years experience in control, research, and development of wrought and cast steels, gray iron, and malleable. Desires position with progressive manufacturing concern or foundry. Address: Box 599, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Wishes contact with a grey iron foundry needing capable man. Have a highly successful record in production of light and medium weight castings. Broad and practical knowledge of cupola operation. Age 45, good personality. Exceptional ability in handling men. Address: Box 653, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRYMAN

Wants to make new connection. Capable, progressive and qualified to direct all foundry activities. Practical experience and technical knowledge. Broad experience producing quality castings. Light, medium and heavy-green and dry sand. Practical and well versed in cupola operation, metallurgy and mix iron by analysis. Cost minded, middle age and good personality. Address: Box 509, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRYMAN

Practical foundryman with technical training. Thirty-two years' experience, including fifteen years of supervision. Well versed in all phases of jobbing and production work on light and medium castings. Considerable experience in nonferrous metals. Ability to handle men. Progressive and up to date in modern methods. Capable of taking complete charge of medium size foundry. Available at once. Address: Box 641, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER OR SUPERINTENDENT

Practical, experienced, well versed in production methods and cost. Jobbing and production of grey iron, malleable and steel. Not a floater. Address: Box 637, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN

Would like a formanship. Have had a number of years' experience both dry and green sand. Experienced on machines and bumpers. Can oversee core room. Address: Box 594, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

PRACTICAL FOUNDRYMAN

With 20 years' experience on jobbing and production work on malleable, aluminum and brass wishes connection with reliable firm. Metallurgy and sand control experience. Good rigger. A-1 reference. Age 38, married. New England preferred. Address: Box 654, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Practical gray iron foundryman technically trained. Wide background of experience and knowledge in all departments of jobbing or production foundries and all modern methods. Well versed in metallurgy. Good labor relations. Want to make connection with company in need of foundryman of my experience. Address: Box 624, The FOUNDRY, Cleveland 13, Ohio.

PATTERNMAKER FOREMAN

Mature, widely experienced in designing and constructing wood, metal and composition patterns, large and small for all classes of castings. Can solicit work and estimate cost from drawings, lay out work, make or supervise and set rates. First class mechanic. Can make wood or metal rush jobs in shop. Extended intimate foundry experience machines, core blowing, driers and gating. Address: Box 465, The FOUNDRY, Cleveland 13, Ohio.

PRODUCTION CONTROL

Young married man, seven years' general experience in covering most phases of foundry work. Worked five years in charge of foundry production, shipping, personnel and purchasing. Have good knowledge of actual foundry practices. Employed at present in responsible position. Would like very much to make contact with firm in California or Arizona. Able to furnish very good references. Address: Box 579, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Fifteen years' experience, complete knowledge of stainless steel casting production, excellent record, presently employed, seeks connection with company producing castings exclusively. Will travel. Location of position unimportant. Address: Box 620, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Young aggressive foundryman wishes connection with reliable foundry. Sixteen years' experience iron and steel; sand control, metallurgy, heat treating and melting. Capable of taking complete charge of your operations. Cost minded. Now employed. Address: Box 623, The FOUNDRY, Cleveland 13, Ohio.

CHARGE OF CORE ROOM

Desires position in charge of core room. Must be in complete charge. Have over twenty years' experience. Honest and ambitious, experienced in grey iron and aluminum. Address: Box 360, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Twenty-eight years' experience as foundry superintendent and practical molder. Understands cupola practice thoroughly. Technical education. Prefer position with foundry making high grade castings. Address: Box 619, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Grey Iron, malleable and steel foundry experience. Technically trained. Knows mechanized foundry operation, sand and metal control. Successful record in reducing scrap losses. References submitted on request. Address: Box 539, The FOUNDRY, Cleveland 13, Ohio.

PRACTICAL FOUNDRYMAN

With 20 years as assistant superintendent and superintendent on floor, pit and machine molding. Electric steel, open hearth steel and gray iron. Can furnish best of references. Address: Box 455, The FOUNDRY, Cleveland 13, Ohio.

SAND TECHNICIAN

Desires position with Eastern Foundry. Ten years' technical and practical experience. Address: Box 544, The FOUNDRY, Cleveland 13, Ohio.

MECHANICAL-ELECTRICAL ENGINEER

Exceptionally broad experience in management, plant engineering, production layout and methods, tool, die and special machine design applying to the foundry, steel mill, forging, machining and metal fabricating industries. Address: Box 597, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

GRAY IRON FOUNDRY MANAGER OR SUPERINTENDENT

McLain graduate, 25 years' experience in all phases of production or jobbing, also pattern engineering. Wishes to connect with medium sized foundry. Eastern states preferred. Address: Box 264, The FOUNDRY, Cleveland 13, Ohio.

INCREASE PRODUCTION ELIMINATE TROUBLES

All types of foundry problems solved by metallurgist and foundry production engineer, experienced in gray iron, semi-steel, brass, bronze and aluminum castings, molding, core making, grinding, cleaning and shipping. Address: Box 589, The FOUNDRY, Cleveland 13, Ohio.

STANDARDS & METHODS

Are you looking for a capable and industrious leader for your Standards & Methods Dept.? Twenty years' experience in malleable, gray iron and steel foundries. If you want better methods, increased production and reduction in cost, then let your problems be handled by a well qualified foundry engineer. Address: Box 283, The FOUNDRY, Cleveland 13, Ohio.

MAINTENANCE OR PLANT ENGINEER

Eighteen years' experience in supervision of all types electrical and mechanical maintenance and construction. Well qualified with experience in cost reducing, plant layout and production machining. Can furnish best of references. Address: Box 606, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Practical gray iron foundryman age 47 technically trained with metallurgical background. Twenty-six years' broad experience producing quality castings from molder to superintendent. Experience covers conventional type and highly mechanized foundries pouring 225 tons daily. Well versed in all departments. Can work from blueprints. Desire new connection in East with reliable firm needing high grade foundryman. Please supply full details in first letter. Address: Box 644, The FOUNDRY, Cleveland 13, Ohio.

GOOD CORE ROOM MAN

Desires to make a change. Thoroughly experienced in gray iron. Knows how to make the most intricate cores. College graduate. Considerable supervisory experience. Address: Box 601, The FOUNDRY, Cleveland 13, Ohio.

PRACTICAL STEEL FOUNDRYMAN

Open hearth and electric, carbon, high manganese and all alloys. Best of references. Address: Box 658, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON METALLURGIST

Young man desires permanent position with progressive foundry. Northeast preferred. College training. Practical experience molding, melting, sand and iron control. Address: Box 622, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Capable of taking complete charge of all foundry operation in both gray iron and brass. Technical graduate in mechanical engineering. Twenty-five years of experience in both light and heavy jobbing and production work, specializing in machine tools and pressure castings. Eighteen years of experience as foreman, superintendent and foundry manager with a clean record. References available from all former employers. Have had actual experience in molding, core making, melting and metallurgy of both gray iron and brass. Having worked at the trade has enabled me to acquire a good management-employee relationship. Address: Box 657, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT NONFERROUS FOUNDRY MASTER MOLDER

Broad practical experience on steam valves, plumbing, hardware, art bronze, jobbing and production work. Address: Box 578, The FOUNDRY, Cleveland 13, Ohio.

Representatives Wanted

MANUFACTURER'S REPRESENTATIVE

Wanted for leading permanent mold foundry. Write stating territory covered, type of accounts now handled, background, etc. Address: Box 632, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Representatives Wanted

SALES REPRESENTATIVES
For Wisconsin, Indiana, Ohio, Pennsylvania, northern New York and New England states to handle proven line of core oils and core binders. Organization with established clientele in their respective territory preferred. Address: Box 636, The FOUNDRY, Cleveland 13, Ohio.

TECHNICAL SALESMAN
We have the money and equipment required to manufacture core oil—located in Southwestern Ohio. Would like arrangement with someone who could formulate and sell on profit sharing basis. Address: Box 646, The FOUNDRY, Cleveland 13, Ohio.

Work Wanted

ALUMINUM SAND CASTINGS
JOLT SQUEEZE MACHINES AVAILABLE
Plate Size up to 16 x 18"
CORE BLOWERS
INQUIRIES SOLICITED
LYCOMING FOUNDRY CORPORATION
MONTGOMERY, PENNSYLVANIA

Opportunities

90 PER CENT OF THE CUPOLAS MELT UP TO ONLY 50 TO 60 PER CENT

capacity per hour—although the best and hottest iron is produced only when cupola is operated to its capacity. Report on your cupola may prove an eye-opener—usually the savings are surprising. Every pound of steel used in cupola mixtures reduces cost and increases strength 20 to 60%, because steel is purer than the most expensive pig iron. Watch the scrap pile—statistics prove casting losses can be held between 1 to 5% depending on the line of work. Our system is not an expense—but a valuable investment. Synopsis free.

McLAIN'S SYSTEM INC.
236 E. NORTH AVE.
MILWAUKEE, 12, WIS.

OPPORTUNITY
We can furnish empty tight and slack wooden barrels also steel drums for your products. ADDRESS: BUCKEYE COOPERAGE STATION, C.P.O. BOX 1501, CLEVELAND, OHIO.

Open Capacity

OPEN CAPACITY
Aluminum foundry in Western New York. Castings up to 125 pounds, production or jobbing work. Address: Box 629, The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY

Wanted for the manufacture of 22% Nickel content nickel silver castings ranging between 30 and 80 lbs., each. Same are to carry high polish. We will be interested to hear from foundries who have had experience in casting this alloy and who have open capacity immediately available.

BOX 640
THE FOUNDRY CLEVELAND 13, OHIO

ALUMINUM CASTINGS
We have open capacity to produce high quality aluminum castings from the smallest to 100 lbs. Lowest prices on production runs. Address: MORR BROTHERS FOUNDRY, KENDALLVILLE, INDIANA.

Open Capacity

CASTINGS

Grey Iron
10 to 300 lbs.

FISHER & NORRIS
TRENTON, N. J.

ANNOUNCING
CASTINGS
SERVICE
INC.

1534 Seventh Avenue, West
Birmingham 4, Alabama

IF IT'S CASTINGS YOU REQUIRE
MAIL YOUR INQUIRIES

This is a service organization staffed with experienced foundrymen, specializing in the placement and inspection of castings of all kinds for the account of the purchaser.

CAPACITY AVAILABLE
Have line of cast grey iron or aluminum toys including very old penny banks and modern trucks. Would like to contact foundry interested in making these toys. Have thirty years' general patternshop experience in wood or metal. Can take over pattern work and make it show profit. Location anywhere. Address: Box 564, The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY
Squeezer, jobbing, rollover work in grey iron castings. Quality and prompt service assured Prefer squeezer assignments from mid-west section near our Kansas plant. Address: Box 339 The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY
Central Wisconsin grey iron foundry. Plenty of coke and pig iron assures you prompt and quality service. Squeezer jobs preferred. Address: Box 580, The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY
Open capacity in grey iron foundry. Waterfronts—burners—bench, bumper and floor work. Address: P. O. Box 321, Belleville, Illinois.

OPEN CAPACITY
CASTINGS
Metallurgical controlled production of gray iron, semi-steel, brass, bronze and aluminum castings in jobbing, semi-production and mechanized production foundries. Address: Box 588, The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY
Have open capacity for aluminum castings on squeezer machines, also floor work. Address: FRANCIS MFG. CO., RUSSIA, OHIO.

OPEN CAPACITY
Grey iron castings machine and floor #10 to 5000#. Address: P. O. Box 869, Joplin, Missouri.

AVAILABLE CAPACITY
Our foundry has open capacity to supply small and medium size gray iron castings. Send sample. Address: OREGON CASTINGS CO., RD 3, Lititz, Pa.

Foundries for Sale

FOUNDRY FOR SALE

All or part interest in GREY IRON JOBBING FOUNDRY. Light and heavy floors. Capacity: 15-20 tons per day. Location—near Cleveland, Ohio.

Box 582
The FOUNDRY Cleveland 13, Ohio

FOUNDRY FOR SALE
Grey iron foundry well equipped with large possibilities. If you are looking for a good foundry and plenty of available space to expand at a bargain, answer this ad. Address: Box 650, The FOUNDRY, Cleveland 13, Ohio.

Foundries for Sale

ALUMINUM FOUNDRY FOR SALE
REASONABLY PRICED FOR QUICK SALE

Our foundry has 6 jolt squeezers, 2 loose work benches, a Royer, 2 large Core ovens, an air compressor with tank, pipes and fittings, 4 Campbell Hausfeld 300# gas furnaces with blower, a 36" band saw, 2 grinders, 1 backstand belt grinder, ample fans for the comfort of the workers, a Macleod Sand Blast Machine, and a large selection of flasks and bottom boards. There is a locker room with showers and lockers for 50 men. Set up for high production. 3800 sq. ft. floor space.

Location: Cincinnati, Ohio Sale Price $19,000.00

BOX 577
THE FOUNDRY CLEVELAND 13, OHIO

CAST IRON PIPE FOUNDRY
Established business operating at capacity with large backlog. Opportunity for expansion or for jobber or large contractor to secure steady source high grade pipe. Profits will pay for business in few years. Address: Box 656, The FOUNDRY, Cleveland 13, Ohio.

ALUMINUM AND BRONZE FOUNDRY
Medium size. Long established profitable business in eastern U. S. Modern buildings and equipment, low break even point. Capable organization and good labor conditions. Steady profitable business with substantial customers. Large backlog of orders. Owners retiring. Exceptional investment or expansion opportunity. Address: Box 655, The FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY FOR SALE
Electric furnace steel foundry located in the heart of heavy industrial section of Ohio, on main line of Pennsylvania Railroad, with siding. All equipment in good operating condition. Foundry does not take in all of land, offering good possibilities for further expansion. For details, survey and photographs write: 9306 EAST 72nd STREET, CLEVELAND, OHIO.

NONFERROUS FOUNDRY
Small foundry in up-state Michigan — well equipped. Two furnaces, two molding machines, one molding bench, air compressor, grinder, snap-flasks, bands and boards. Good business now operating. Orders on hand and more to be had. Leaving the state first of year. Will sell complete for $8,000.00. Address: Box 609, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE
Medium sized foundry suitable for sand or permanent mold nonferrous castings. Cleveland district—good labor supply. Will sell all or part interest to person qualified. Address: Box 614, The FOUNDRY, Cleveland 13, Ohio.

GREY IRON FOUNDRY FOR SALE
Complete with pattern and machine shop. Going business with 27 years' successful operation. Ideal location in growing industrial section of Texas. Well established demand for product. Price $125,000. Terms. Address: Box 612, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE
Small brass and aluminum foundry. Has plenty of orders, needs management. Located in small town in Northern part of Michigan. Address: Box 574, The FOUNDRY, Cleveland 13, Ohio.

ALUMINUM PERMANENT MOLD FOUNDRY
Completely equipped for light and heavy manufacturing and assembly. With large separate enclosed paint and lacquer department equipped with spray booths, pressure tanks, compressors, etc. Modern brick factory building. Located near Bridgeport, Conn. Ten year lease, rent $400.00 per month. Approximately 18,000 feet. Address: Ranel Products Inc., 48 Maple St., Ansonia, Conn.

SMALL GRAY IRON FOUNDRY
Eastern Pennsylvania. Well equipped, with good business and excellent product for sale on easy terms to person who can prove his integrity and ability to operate at a profit. Address: Box 542, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRY
Small Northwestern Ohio gray iron foundry producing mostly castings from plated patterns. Capacity 3 to 4 tons daily. Equipment in fine shape. Address: Box 586, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Foundries for Sale

GRAY IRON FOUNDRY

In middle west. Fully equipped for production of 7 floors of light weight work. Sales $17,000 per month. Building under lease. For sale at $20,000.

BOX 651
THE FOUNDRY CLEVELAND 13, OHIO

PRODUCTION AND JOBBING FOUNDRY

70,000 square feet, for manufacturing gray iron, brass and aluminum castings. Daily capacity 20 tons gray iron, 5 tons nonferrous metal. 60" cupola, jolt squeezers, strippers, rollovers, bumpers 2 core ovens, large assortment flasks. Going business. Pittsburgh district. Address: Box 382, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOR SALE

Very profitable pouring 4 to 5 tons per day six days per week. Northern Pennsylvania. Only industry in town. $35,000 total price. Address: Box 660, The FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

WANTED

Mold conveyors
Overhead sand distributing conveyors and chutes
Sand elevators
Shakeout screens
All other equipment and pertaining to a mechanized foundry.
What have you to offer?

BOX 625
THE FOUNDRY CLEVELAND 13, OHIO

WANTED

One complete 7½ or 10 ton overhead crane, 60'0" span, for A.C. current, 220 volt, 3 phase, 60 cycle, for inside service. Address: Box 600 The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRY

Wanted to buy, or lease with purchase option medium size gray iron foundry, preferably in Michigan, Ohio or Indiana. Are now operating small foundry and seeking larger quarters with room for expansion. Address: Box 585, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Pig Iron. Middle west foundry needs pig iron to be able to continue operations. We need 200 tons to complete 1947 schedules. Any amount will help. Prefer a malleable pig iron with silicon 2 to 3%. Address: Box 630, The FOUNDRY, Cleveland 13, Ohio.

WANTED

One—Post jolt squeeze machine. International type PJS or similar with 12" or 13" diam. squeezing cylinder. Address: Box 616, The FOUNDRY, Cleveland 13, Ohio.

WANTED

One—3' x 8' model BG Simplicity shakeout machine. Address: GUNITE FOUNDRIES CORP., ROCKFORD, ILLINOIS.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price for immediate acceptance. Address Box 578, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Lectromelt "V" type furnace. Address: Box 621, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Medium sized aluminum foundry in Cleveland. Give price, location, floor space, equipment, etc. All replies confidential. Address: Box 643, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Detroit rocking furnace 300 to 700 lbs. capacity or induction furnace 100 to 300 lbs. in good condition with transformer and controls. Address: Box 520, The FOUNDRY, Cleveland 13, Ohio.

WANTED

One #60 or 70 Speedmuller (loader not necessary).
The Dayton Steel Foundry Co.
P.O. Box 1022 Dayton 1, Ohio.

Wanted-To-Buy

WANTED

1—Used Sandmuller, 4 to 6 cu. ft. capacity. Give full specification and condition of machine. Reply: P. O. Box 29, Ellwood City, Pa.

Employment Service

SALARIED POSITIONS
$2,500-$25,000

This thoroughly organized confidential service of 37 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details.

R. W. BIXBY, INC.
101 Dun Bldg. Buffalo 2, N. Y.

SALARIED PERSONNEL

$3,000—$25,000. This reliable service, established 1927, conducts confidential negotiations for high-grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS, DEPT. T, 109 CHURCH STREET, NEW HAVEN, CONN.

For Sale

FOR SALE

1—10 ton Northern Overhead Crane, 50' span, 215-230 Volt DC with generator set—Price $4000.00
1—6 ton Northern Overhead Crane, floor controlled, 215-230 Volt D.C. 46' span—Price $2000.00
1—Ingersoll-Rand Steam Air Compressor. Steam cylinder 10 x 10; Air cylinder 12 x 10 Serial #34826—Price $1000.00
1—Herman Jolt Rollover Machine 40" x 72"—Price $500.00
3—Core Oven Cars, approx. 6' x 9' for 58" gauge track—Lot $500.00
5—Core Oven Drawers with wheels; size 3' x 7'—Lot $350.00
4—Core Oven Drawers with wheels; size 4' x 9'6"—Lot $350.00
1—U. S. Electric Variable Speed Grinding Stand, 220-440 volt—Price $300.00
All prices net cash and f.o.b. Anderson, Indiana. Write or Phone P. B. Lavelle, Box 798, Anderson, Ind., Phone 4441.

FOUNDRY EQUIPMENT AVAILABLE FOR IMMEDIATE DELIVERY, SUBJECT TO PRIOR SALE

#9 Model B Whiting cupola, late model, f.o.b. Mansfield, Penna.	$2500.00
#104 Milwaukee Portable Jolt Squeeze Molding Machine	$ 275.00
American sand cutter, with motor	$ 550.00
Core ovens, oil fired, size 6 x 6 x 6 ft.	$ 400.00
#1 Model Tableblast, manufactured by the American Wheelabrator Corporation, 6 ft. table, late model, roto-blast	$1850.00
28 x 21 International power rollover draw molding machine	$ 220.00
1 Master benchrammer, size 1S, serial #74013 peen	$ 45.00
18 x 22 Portable Osborn jolt squeeze strip molding machine	$ 250.00
Schutte & Koerting tilting type tumbling and washing barrel, geared, inside dimensions of barrel 24" deep, 28" wide, inside of barrel 1⅜" bronze lined, self-contained, V-belt motor drive with A.C. motor for rotating barrel, push button controls	$ 450.00

BILLARD MACHINE & TOOL COMPANY
PHONE 44 MANSFIELD, PENNA.

FOR SALE
WHITING PULVERIZERS

Three No. 30 and two No. 40 with or without motors. Excellent condition. Address: LAWRENCE PORTLAND CEMENT CO., 150 BROADWAY, NEW YORK 7, NEW YORK.

For Sale

FOR SALE

Stainless Steel Welding Electrodes 25/20 Type #310
20,000 lbs. ¼" Diameter—A. O. Smith Mfg.
20,000 lbs. 5/32" Diameter—A. O. Smith Mfg.
20,000 lbs. 3/16" Diameter—Harnischfeger Mfg.
Price 25c per lb.—Minimum order of 500 lbs. f.o.b. Philadelphia, Pa.

J. A. DOUGHERTY
156 Vassar Road Bala-Cynwyd, Pa.

FOR SALE

1—Wilbraham-Green cupola blower complete with base and 50 H.P. motor, 220 V., AC.
1—50 H.P. slip-ring motor, 3 P.H., 60 C., 220 V., 900 R.P.M.
3—Molding Machines
1—Norton floor grinder
2—Blowers
1—12" inside diameter by 7' 4" Whiting hoisting cylinder with piston.
1—Monarch electric box welder, 110 V

GREEN BAY SOAP COMPANY
GREEN BAY, WIS.

FOR SALE

5—Int. Type R.J. power jolt hand R.O. & hand draw, Boxes 14" wide—8" draw.
1—Tabor power jolt hand rollover machine, Boxes 20" x 8".
6—International Type J.D.P. power jolt—power pin lift—table 24" x 36"; lift cap.—1600 lbs., height 10 inches—adjustable pin centers to 27" x 37".
1—International Type J.D.P.—will handle flasks 48" x 48"—capacity 3000 lbs.—10" lift.

1—Tabor Cut-off Machine with 10 H.P., 220/440 Motor—like new.
2—Beardsley & Piper Screenarators—Model S.
1—New Belt for N.D.P. Royer.

Registered as an Approved Dealer by War Assets Administration. Send us your inquiries.
Ray P. Scully
SCULLY MACHINERY & EQUIPMENT CO., Not Inc.
767 MILWAUKEE AVE.
CHICAGO 22, ILL. PHONE: CANAL 0314

TURBO BLOWERS

2100 cfm @ 10 oz. Spencer, with 10 HP, 220/440 V, 3/60/3600 RPM motor.
(4) 675 cfm @ 6 oz., Spencer, driven by 2 HP, 220/440 V., 3 ph. 60 cycle 3600 RPM

PRESSURE BLOWERS

1400 cfm @ 8 oz., Robinson with 5 HP, 3 ph, 60 cy. 3600 RPM motor.
1100 cfm @ 16 oz. Sturtevant 8 x 8, 24" dia. wheel
800 cfm @ 24 oz. Amer. Blower with 10 HP, 220/440 volt, 3 ph, 60 cy. 3600 RPM.
500 cfm @ 14½ oz. McKee 6 x 6 with 5 HP, 3600 RPM.
450 cfm. Allen Billmeyer, V-belt drive.

THE MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND 14, OHIO

WOOD SNAP FLASKS

We are offering for sale approximately eighty (80) tapered wood snap flasks, varying in size from 8½" to 18" wide, 13" to 30" long. Write for list of sizes and prices. All sales cash with order, f.o.b. our plant, Sandusky, Ohio. Will quote attractive price to anyone interested in purchasing entire lot. Address: The G. & C. Foundry Co., Sandusky, Ohio.

Classified Advertising

For Sale

MELTING EQUIPMENT FOR SALE

Good Modern Equipment Company skip charger, used only about two years and a 78" Whiting cupola. Real buy. See these at/or direct all inquiries to: NATIONAL MOTOR CASTINGS DIVISION OF CAMPBELL WYANT & CANNON FOUNDRY COMPANY, SOUTH HAVEN, MICHIGAN.

OVERHEAD ELECTRIC TRAVELING CRANES

QU	TONS	MAKE	SPAN	CURRENT
2	3	Shepard	18'0"	230-VDC
1	5*	Northern	14'0"	230-VDC
1	5*	Shaw Box	30'0"	230-VAC
1	5*	Northern	37'0"	230-VDC
1	25/5	Niles	80'0"	230-VDC

*LOWHEAD ROOM TYPE.

MONORAIL ELECTRIC HOISTS

QU	TONS	MAKE	CURRENT
2	½	LoHed	230-VDC
6	½	Shepard	230-VDC
1	1	Shaw Box	220-VAC
1	1	Wright	118-VDC
1	1	Box	230-VDC
1	3	Shepard	230-VDC
1	3*	Shepard	230-VDC
3	3*	LoHed	230-VDC
3	5*	LoHed	230-VDC

*2 motor FL. Op. Hoists we can supply them with cages.

3—¼ ton Yale stationary mounted hoists, 120 VDC, wrap 77' of ⅛" cable, 85-FPM., with 3-HP. motor (will furnish these arranged for 230-VDC)

ALL ABOVE IN STOCK OFFERED REBUILT & GUARANTEED.

SEND FOR OUR STOCK LIST OF A.C. & D.C GENERAL PURPOSE CRANE & MILL MOTORS, ELECTRIC BRAKES & CONTROL EQUIPMENT, MOTOR GENERATOR SETS, TRANSFORMERS, ETC., OF ALL SIZES.

T. B. MACCABE COMPANY
4300 CLARISSA ST.
PHILADELPHIA (40), PENNA.

FOR SALE

"American" sand blasting machine—used
Size—60 x 30 x 34
Type—No. 2 suction
Price $150.00

AJAX ALLOY FOUNDRY, INC.
32 SOUTH FRANKLINTOWN ROAD
BALTIMORE 23, MD.

FOR SALE
NEW AND UNUSED EQUIPMENT

1—No. 56 Sly Dust Filter, type 360 with Bag Shaking device complete with motor 440/3/60, including Magnetic starter, timer, structural support, exhaust fan, V-belt drive, fan house and structural support.

THE LENNOX FURNACE CO.
400 N. Midler Ave.
Syracuse, N. Y.
Contact J. K. Dougherty

FOR SALE

One #2 Simpson muller with bucket loader equipped with new tires and 15 H.P. motor, 850 R.P.M., 60 cycle.

H. W. CLARK COMPANY
MATTOON, ILLINOIS

FOR SALE

One Detroit type AA, 1000 lb. cold metal charging capacity, 220/3/60 motor and controls, transformer 12000 volts primary, control panel. Good condition. No longer needed.

THE DURIRON CO., INC.
PUR. DEPT.
DAYTON 1, OHIO

FOR SALE

New heavy duty motorized rod cutter, 65 cuts per minute; capacity: ⅜ inch round hot rolled steel. Brand new. $890.00 f.o.b. Cleveland. Address: The Federal Foundry Suply Co., 4600 East 71st St., Cleveland 5, Ohio.

FOR SALE

Steel flasks, new. 50 sets 26 x 26" cope 6" drag 4" double pinlugs ¾" pins, lifting handles, trunnions and clamp lugs. Price on application.

PENNSYLVANIA FOUNDRY SUPPLY & SAND CO.
LEWIS & ASHLAND STS.
PHILADELPHIA 24, PA.

FOR SALE

1—#91 Osborn Core Blower (New)
1—Simplex #94, Oil-Fired Furnace and Blower
1—Fisher, Type S, 4-Burner Gas-Fired Furnace—$400.00
500—Transite Core Plates—30" x 6"
2—Kane & Roach Motorized wire straighteners —⅛—¾"

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 EAST BROAD ST.
SHILLINGTON, READING, PA.

FOR SALE

20—13" and 14" combination Jolt Squeeze Strip Molding Machines, completely overhauled.

Sutter Products Co.
2005 Westwood Ave., Dearborn, Michigan

FOR SALE

Whiting hydro-clone spark suppressor for #4 Whiting cupola. Has been kept painted and never been used. Will sacrifice for $1250.00, cost new $2500.00.

NUTMEG CRUCIBLE STEEL CO.
BRANFORD, CONN.

FOR SALE

1—Used model "M" size 89/70 American sand cutter.
8—Used metal Sly tumbling barrels with shafting and pulleys.
4—Never used oil fired, iron pot, 500 lb. capacity, #900, Hausfeld tilting type aluminum furnaces.

CONNECTICUT FOUNDRY CO.
ROCKY HILL, CONN.

FOR SALE

1 One-ton Shaw Box Hoist.
1 1000 pound Shaw Box Hoist.
3 No. 104-5 Milwaukee Jolt Squeezers, with pop-off valve and gauge, New.
2 Standard Electrical Model 100 Heavy Duty Grinder, New.
1 Hand operated Rollover.
1 15 H.P. Brown-Brockmeyer Electric Motor.
1 Jeffrey Pan Vibrating Conveyor 18" x 11'-3"—New.

For details write:

STERLING CASTING CORP.
BLUFFTON, INDIANA

FOR SALE

Six hollow trunnion Tumbling Mills, usable condition, replaced with other equipment.

2 20 x 20 x 42 Square Gear driven
1 30 x 30 x 56 Square Gear driven
1 34 x 48 Round Gear driven
1 33 x 54 Round Friction driven
1 31 x 60 Round Friction driven

Priced to sell, inspection here.

STANDARD STOVE & RANGE CO.
ROME, GEORGIA

FOR SALE

1—Simplicity sand cutter, 2' x 3', Model C portable. Excellent condition.
2—Light jolt squeeze molding machines. Good condition.

ACME FOUNDRY & MACHINE COMPANY
COFFEYVILLE, KANSAS

FOR SALE

1 Simplicity sand cutter, 2' x 3', used about 2 months. Excellent condition. $700.00. Address: Box 602, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

The following well-organized and profitably operating plants are individually offered for sale on entirety basis as a going business.

STOVE MANUFACTURING PLANT

Alabama coal and iron area. Cupola capacity, 17 tons hourly. Amply supply fully trained native help. Buildings approximately 50,000 square feet.

FULL FASHIONED NYLON HOSIERY MANUFACTURING PLANT

45 and 51 gauge. 2500 dozen weekly capacity. Location, East. Excellent building, humidification and temperature controlled throughout.

TOP QUALITY CABINET AND SPECIALTY MANUFACTURING PLANT

About $1,000,000.00 current annual volume. Location, East. Complete wood working and finishing equipment.

HOSIERY DYEING AND FINISHING PLANT

Currently 20,000 dozen weekly. Optional, rental or purchase of valuable ground and building. Location, East.

Inquiries Invited

JOSEPH HAINES, JR. & SONS
JENKINTOWN, PENNSYLVANIA
Brokers in the Sale of Industrial Plants

FOR SALE

1—Simplicity Shake-out Screen without Motor 6'6" x 5'2"
2—#193 Osborne Coreblowing Machines
2—#194 Osborne Coreblowing Machines
2—#60 Beardsley & Piper Speedmullers without motor
1—#40 Beardsley & Piper Speedmuller without motor
2—International type R, Hand Ram, Hand Rollover Moulding Machines.
2—Royer Portable Sand Blending Machines
1—North American Tubular Blower 2,000 CFM, 32 ounce, 30 H.P., 3500 RPM, 440 Volt, 3 Phase, 60 Cycle A.C.
1—Spencer Tubular Blower 1300 CFM, 32 Ounce, 25 H.P., 1750 RPM, 440 Volt, 3 Phase, 60 Cycle A.C.

MARCH BROWNBACK CO., INC.
SOUTH & CHARLOTTE STREETS
POTTSTOWN, PA.

FOR SALE

#9—84" Whiting Cupola complete with Piqua positive type blower, 50 HP G.E. 440—60 cy. 865 RPM Motor, mounted on same base. In excellent condition used only 6 mo. Price $3000.00 F.O.B. Alpena.

DIE TOOL ENGINEERING CO.
PHONE 834
ALPENA, MICHIGAN

FOR SALE

Two new machines never used. Johnston & Jennings molding machine #815 and Arcade jolt pin lift machine #5207. Address: Mundie Mfg. Co., Aurora, Ill.

Classified Advertising

For Sale

OVERHEAD CRANES

1-TON
Curtis 24′ Span
Detroit 10′ Span
Detroit 18′6″ Span
Cleveland 38′ Span
Euclid 40′ Span
Shepard Niles 12′ Span
2-TON
Conco 12′ Span
Louden 19′2″ Span
Northern 28′ Span
P&H 31′10⅜″ Span
3-TON
Shaw 51′2″ Span
Chicago Tramrail 27½′ Span
P&H 37′6″ Span
P&H 42′1½″ Span
5-TON
Alliance 95′ Span
Crane 47′3″ Span
Crane 76′ Span
Detroit 38′8″ Span
Case 35′ Span
Detroit 34′ Span
Northern 32′ Span
Northern 22′ Span
P&H 31′10″ Span
P&H 72′1″ Span
Crane 37′3″ Span
Crane 57′3″ Span
Shepard 27′6″ Span
6-TON
Shaw 21′10½″ Span
7-TON
Charging & Quenching Cranes 32′ & 36′ Spans
7½-TON
Northern 26′7½″ Span
8-TON
P&H 80′ Span
10-TON
Lane 60′ Span
Cleveland 51′3″ Span
2 Yd. Morgan Bucket Crane 60′ Span
Shaw 67′6″ Span
P&H 87′6″ Span
Shaw 80′9″ Span
Alliance 58′5″ Span
Lane 50′ Span
15-TON
Overhead Crane 74′4″ Span
Outdoor Crane 57′5½″ Span
Alliance 48′9½″ Span
New Albany 50′6″ Span
Morgan 82′ Span
Northern 76′ Span
P&H 40′ Span
Whiting 38′ Span
20-TON
Overhead Crane 60′ Span
Whiting 48′6″ Span
Whiting 75′ Span
Shepard Niles 48′6″ Span
P&H 51′4″ Span
P&H 37′ Span
25-TON
Alliance 38′2″ Span
Bedford 67′8″ Span
Case 63′ Span
Overhead Crane 74′4″ Span
P&H 80′ Span
30-TON
Morgan 55′ Span
Northern 75′ Span
35-TON
Overhead Crane 74′4″ Span
40-TON
Niles 151′9½″ Span
50-TON
Alliance 52′ Span
Morgan 50′ Span
75-TON
64′8¼″ Span

Telephone us collect to discuss your requirements

ECONOMY COMPANY, INC.

49 Vanderbilt Avenue — **New York 17, N. Y.**

Telephone: Murray Hill 4-1616

FOR SALE

1—Whiting #9½ Model B Cupola section E 45′ with Tuyeres. Self segments, arranged for 9″ thick lower lining. C.I. charging door frame wishbone and grapple.
1—3 Ton capacity Horseshoe charging trolley 11′ span 34′ lift equipped with GE 3 HP and 15 HP traction and lift slip ring motor 3-60-220 60 FPM drum controllers, resistance grids, including switches, trolley system, etc.

BOX 523
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE
INTERNATIONAL JOLT-STRIP

One Type-J.D.P. Heavy Duty 1600 lb. Jolt Ram, Air Pin Lift Machine, 18″ x 48″ Table, Lifting Pins can be adjusted to take 34″ flask.

This machine has a 10″ Draw. Fig. 26, Page 12, International Molding Machine Catalogue. Machine still in crate.

BOX 613
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE

Long established, successful, gray iron foundry, located on Niagara frontier. Owner wishes to retire.

BOX 558
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE

1—30 x 38 tumbling barrel only
4—18 x 52 tumbling barrels only
1—36 x 60 square tumbling barrel on single line shaft with
1—30 x 60 round barrel
2—24 x 54 tumbling barrels complete with shafts
1—Besley disc grinder 26″ dia. complete, less motor $75.00.
1—Osborn 405 jolt rollover
1—coal conveyor, condition fair, bargain

BOX 517
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE

2—#275 Osborn P.J. jolt squeeze swing head 10″ molding machines #11685 serial FS & FD.
2—12 x 16 Adams aluminum slip flasks.
20—12 x 16 Adams jackets.
250—12¼ x 16¼ boards.
All practically new, used two months. Located in Western Pennsylvania. Price $1250.00.

BOX 631
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE

1 Lancaster. Counter current batch mixer, type eag 4, year 1940, number 4077, A.C. 15 H.P. Motor 220-440 volts, 3 phase 1600 R.P.M. 60 cycles (Our #4963 K)
1 Osborne roll over jolt & squeeze. Model #601-13 (Our #7110 K) rebuilt with extra parts
2 Berkshire molding machines. Model 'J' jolt squeeze with ¾″ vibrator. New in cases. (Our #11735C)
1 Sand Royer
1 Sand Sifter

All above subject to prior sale.

MANHATTAN CASTINGS INC.
185 GENESSEE AVE.
PATERSON 3, N. J.

FOR SALE

2—Osborn rollover—air-clamp machines #2033, taking plates 36″ x 50″ with 8″ draw. Machines also have adjustable air controlled table.
1—Hoffman portable vacuum cleaner with 220-440 volt motor; size PC150, serial number 114431. Hose and attachments included. Machine used once and is as good as new.

BOX 633
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE

1—Adams universal jolt squeeze, side rod type, 12″-38″.
1—No. 2 D. M. globe direct drive tumbling barrel, steel shell, motor included, 3 p.h., 60 cy. 220 volt.
2—Stationary furnaces No. 60, oil fired.
1—24 x 48 tumbling barrel.
2—32 x 32 x 48 Sly tumbling barrels.
1—Air compressor 105 cu/ft.

BOX 635
THE FOUNDRY — CLEVELAND 13, OHIO

FOR SALE

Completely overhauled #6 Sturtevant cupola blower, ready to run with starter and 15 H.P., 3 phase, 60 cycle 220/440 induction motor—suitable for #3 or #3½ cupola. Address: LANCASTER FOUNDRY CORPORATION, 434 South HIGH STREET, LANCASTER, OHIO.

FOR SALE

1—No. 2 Demmler core blower. In service a little over one year. Price $900.00 f.o.b. Kewanee. Address: KEWANEE BOILER CORPORATION, KEWANEE, ILLINOIS.

FOR SALE

55″ Cutler Hammer magnet 61 amp., 230 volt, used six months. Address: Box 610, The FOUNDRY, Cleveland 13, Ohio.

MOLDING MACHINE

One practically new 1942 model #918B Johnston and Jennings jolt rollover machine with brand new roll out table. Table size 44″ by 54″. Machine may be inspected at our plant. Price is reasonable. Address: WESTERN LAND ROLLER COMPANY, HASTINGS, NEBRASKA.

EQUIPMENT FOR SALE

MOLDING MACHINES
1—Tabor Combination Jar Rollover Pattern Draw, 40″ x 50″ Table, 21″ Draw, Capacity 2000 lbs.
1—#274 Osborn Plain Squeeze.
3—75J Osborn Portable Jolt Squeeze, Strain Rod Type.
2—Tabor Plain Squeeze, Strain Rod Type.
3—Mumford 3″ Cyl. Core Jolt, with 20″ x 15″ Table.

BLOWERS FOR CUPOLAS AND FURNACES
6—#805 General Blowers, 5 H.P., 3/60/220, 1400 C.F.M. at 8-oz. pressure.
1—10 HP 1300 CFM 16 oz. No. American.
Maxon-Premix Blowers for Gas, ⅛ to 1 H.P.

METAL MELTING EQUIPMENT
1—Style #800 Single Burner Stationary #70 crucible Furnace for gas, complete with lining and #8-A Blower and Motor—220 Volt.
1—Style #600 Single Burner Tilting #150 Crucible Furnace for Gas, complete with lining and #7 Blower and motor—220 Volt.
2—Hausfeld 1000# Aluminum Capacity Furnaces, Barrel Type, Open Flame, Oil Fired.
2—Hausfeld 2000# Aluminum Capacity Furnaces, Barrel Type, Open Flame, Oil Fired.
1—Aluminum Electric Heat Treating Unit, 75 KW, 220 Volt, Batch Type, with Basket and Quench Tank.
2—Hausfeld Open Flame Tilting Brass Furnaces, 400# capacity, Gas or Oil.
3—Stationary Gas Fired #60 Crucible Furnaces, with ¼ H.P. Maxon-Premix Blowers.
2—Monarch-Rockwell Rotating, 500# Brass, Oil.
New 32″ to 41″ Dia. Shell Cupolas made to order.

TUMBLING MILLS AND SAND BLAST
2—(New) Baird No. 3-D Oblique Tumbling Mills, 27″ Dia. 30″ deep, direct motor drive, with motor driven tilting mechanism. Load capacity approx. 400 lbs.
4—New Haven 36″ x 46″ Self Contained Sand Blast Barrels, Belt Drive.
2—Pangborn Syphon Feed Sand Blast Cabinets.
3—Portable Sand Blast Generator Tanks, 500# Sand Cap.

MISCELLANEOUS
1—NB 2 Royer Sand Separator with motor.
1—Type V Combs Foundry Riddle with motor.
1—#4 DG Fired Swarthout Core Oven Complete.
4—Shake-outs, approx. 5′ x 8′.
1—Heavy Duty Back Geared Sprue Cutter, 1½″ square knives, T. & L pulley drive.
1—No. 1 Blystone Sand Mixer, 7 cu. ft., 5 H.P. 3/60/220-440, motor connected.
1—Cloth Screen Dust Collector.
6—Worm Geared Tilting Ingot Mold Stands, 6′ to 12′ long.
7—Hydro-Whirl, Wet Type, Dust Collecting Booths, suitable for Magnesium, Aluminum, Brass, etc. 5′ x 3′ working table and collecting system built as complete unit.
2—Hydro-Whirl, Wet Type, Collectors for double end grinders.

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST.
CINCINNATI 3, OHIO
PHONE PARKWAY 7812

EIGHT EXHAUST FANS

BRAND NEW

120,000 CFM, type "K" Buffalo forge manufacturer. Fans deliver 120,000 CFM @ ½″ S.P., 314 RPM at 110° F.

IRON & STEEL PRODUCTS, INC.

13444 S. BRAINARD AVE., CHICAGO 33 ILL.

"ANYTHING containing IRON or STEEL"

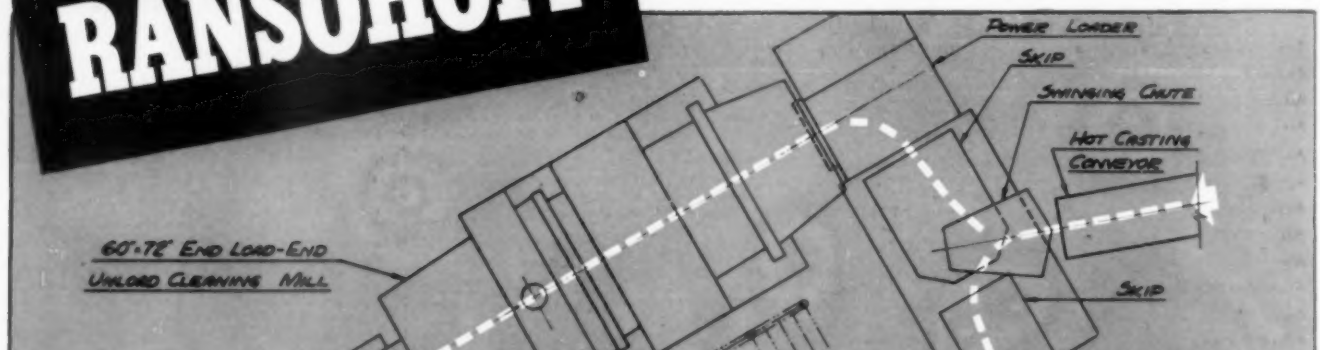
FOR SALE

1—Used—60″ shell-colliau cupola complete with blower and metal duct work. Good condition.

THE BETTENDORF COMPANY
BETTENDORF, IOWA

RANSOHOFF

THE GREATEST NAME IN ENGINEERED CLEANING



LOWEST CLEANING COST PER TON

Engineered design and construction sends costs down and production UP!

RANSOHOFF
WET CLEANING MILLS
WITH
AUTOMATIC
STAR-RETURN

MEMBER

Two end-loading, end-unloading mills in the plant of Kuhns Bros. Dayton, Ohio, manufacturers of "K" fittings, are shown in the plant layout drawing. They clean grey iron pipe fittings.

Castings come from shake-out on a conveyor which dumps them into power loader. Operator starts the batch mill and raises skip which automatically loads the mill . . . work is cleaned for 15 minutes. Then mill is reversed, work is unloaded automatically and separated automatically from the stars. It is then carried away on a sorting conveyor.

SIMPLE . . . GENTLE . . . NO DUST COLLECTING SYSTEMS . . . NO RUST . . . ECONOMICAL . . . NO DESTRUCTIVE MILL WEAR

SAVE 30% TO 70%

SEND A SAMPLE BATCH FOR FREE TESTS AND REPORT

N. RANSOHOFF, Inc.

TOWNSHIP AVE.
AND BIG 4
CINCINNATI 16, O.

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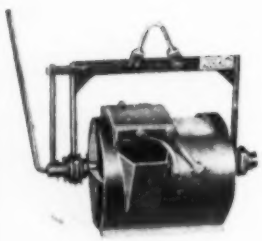

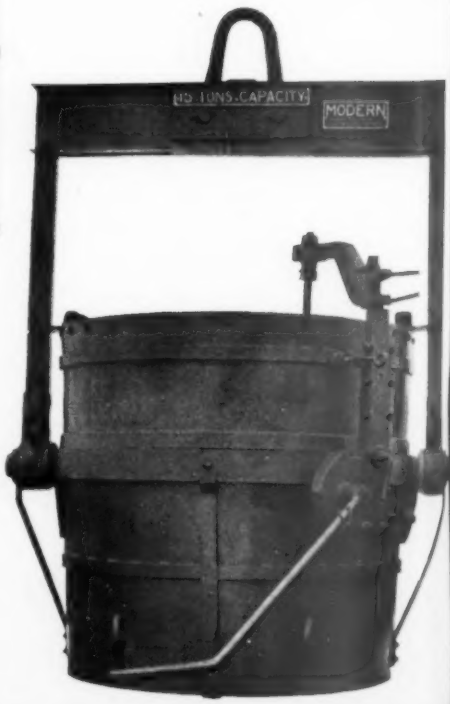

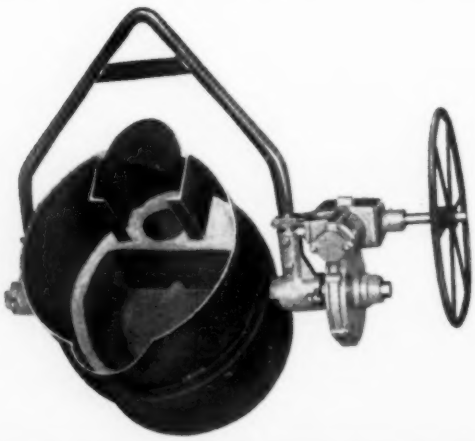

Stevens Liquid Parting

. . . a thin, transparent liquid . . . contains a special blend of waterproofing ingredients combining to form a parting film that will give from 15 to 60 molds for each application. An excellent parting for use on metal matchplates of any metal; on loose patterns and on core boxes.

Quickly and effectively removes dirt and gummy films from metal patterns, plates and core boxes; an excellent rust preventative, and preservative for metal plates and boxes which are to be stored . . . also used on molders' shovels to prevent sand from sticking.

Because it gives so many molds per application it is economical to use; saves time; eliminates dusty air around molders.

Shipped in 1 and 5 gallon cans and 53 gallon drums.

We will gladly send a working sample for you to test under actual working conditions, so sure are we that you will be highly pleased with its working qualities.

. . . and, speaking of Partings . . . try ***Stevens Sno-White Non-Silica Parting*** for perfect lifts of sand from match plates or loose pattern and of cope from drag.

Of fine texture, it clings well to vertical surfaces, making difficult draws easy. Works perfectly on either hot or cold sand.

Packed in paper lined barrels of 450 lbs. net.

Stevens Columbia Parting

. . . a Tripoli base parting, of light creamy color and very fine. It does not pack in the shake bag, but flows easily. Try it on core boxes for the "toughest draws".

Insures clean lifts no matter how complicated the pattern or how difficult the draw. Forms a uniform parting line.

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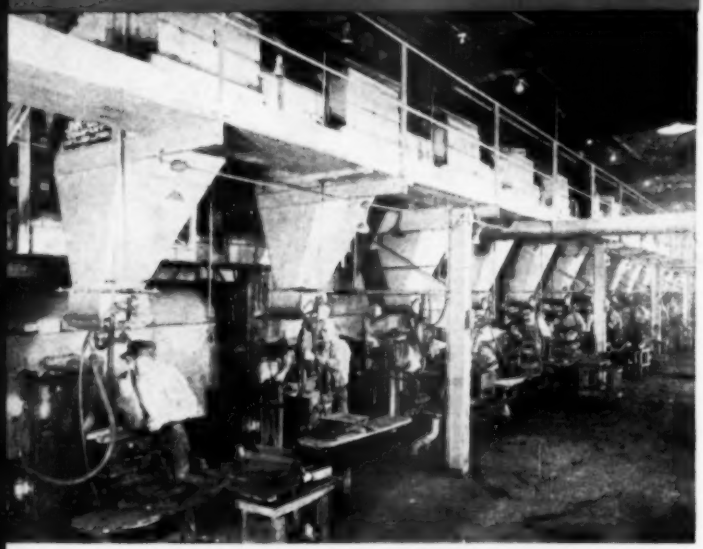
LINK-BELT MECHANIZATION

··the way to lower costs and the efficient use of workers' skill

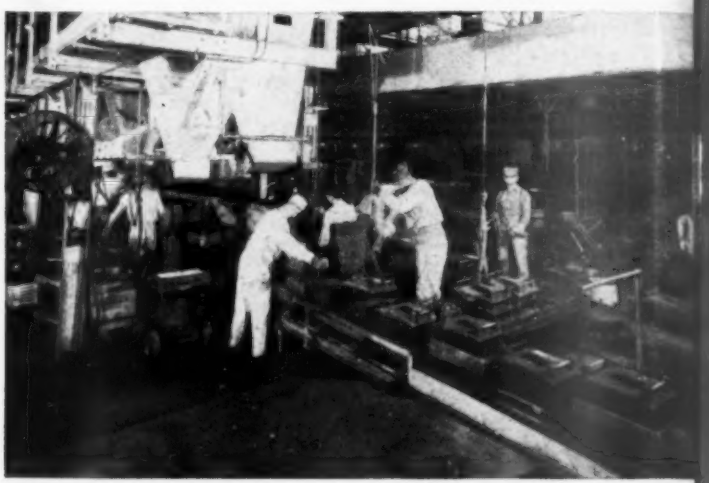
Through mechanization, the foundry industry is fast becoming an ideal place to work. Foundries are replacing arduous, back-breaking tasks with smooth-flowing mechanisms that prepare sand, convey it to the molders' hoppers—move molds to the pouring zone—cool the molds through ventilated enclosures—shake out the molds—convey the castings and cores.

Continuous operations—clean, orderly, rapid and economical. Foundry men become craftsmen, as conveyors, screens, elevators take over the drudgery of foundry work. Labor supply increases—labor turnover decreases—schedules are met more surely at costs that are sharply competitive.

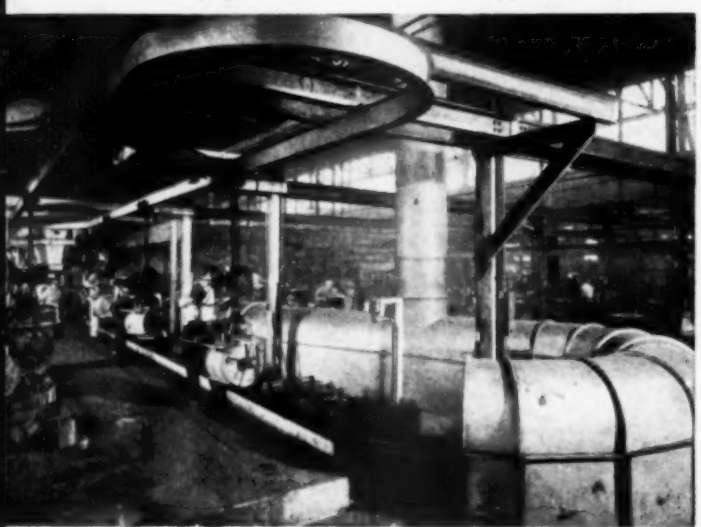
It may be worth your while to investigate the possibilities mechanization holds for you. A Link-Belt engineer will be pleased to discuss it with you.



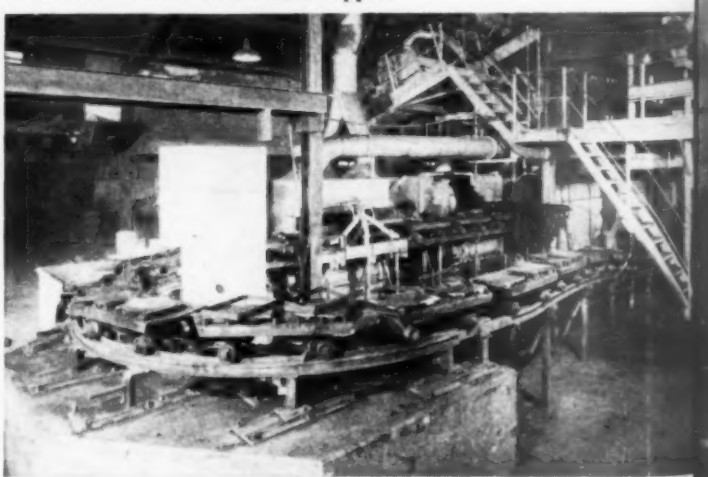
Line of 14 molding stations, at Sibley Machine and Foundry Corporation, South Bend, Ind., with overhead sand hoppers served by distributing belt conveyor. Attendant on footwalk along conveyor sets the discharge plows and sees that sand hoppers are kept filled.



Mold conveyor is moving from molding stations at left through counting station (note seated attendant) and cast iron weight shifting station. Molder is placing a completed mold on conveyor, while man ahead has lifted a cast iron weight from section of gravity roll, with special mechanical tongs that eliminate lifting, and is placing it on top of mold nearest to him. The two men on other side of mold conveyor attend to removing weights and aluminum jackets. Photo also shows overflow sand hopper.



Pouring zone of mold conveyor, showing three men pouring hot metal into molds which then pass through the ventilated enclosure around to other side of conveyor.



Take-up end of continuous mold-conveyor, looking toward two shakeout stations on far side of conveyor and toward sand revivifier (top, center). Note the automatic dumping cam arrangement at second shakeout. Observe also how the conveyor descends from shakeout level to the proper working level along the line of 14 molding stations at right.

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